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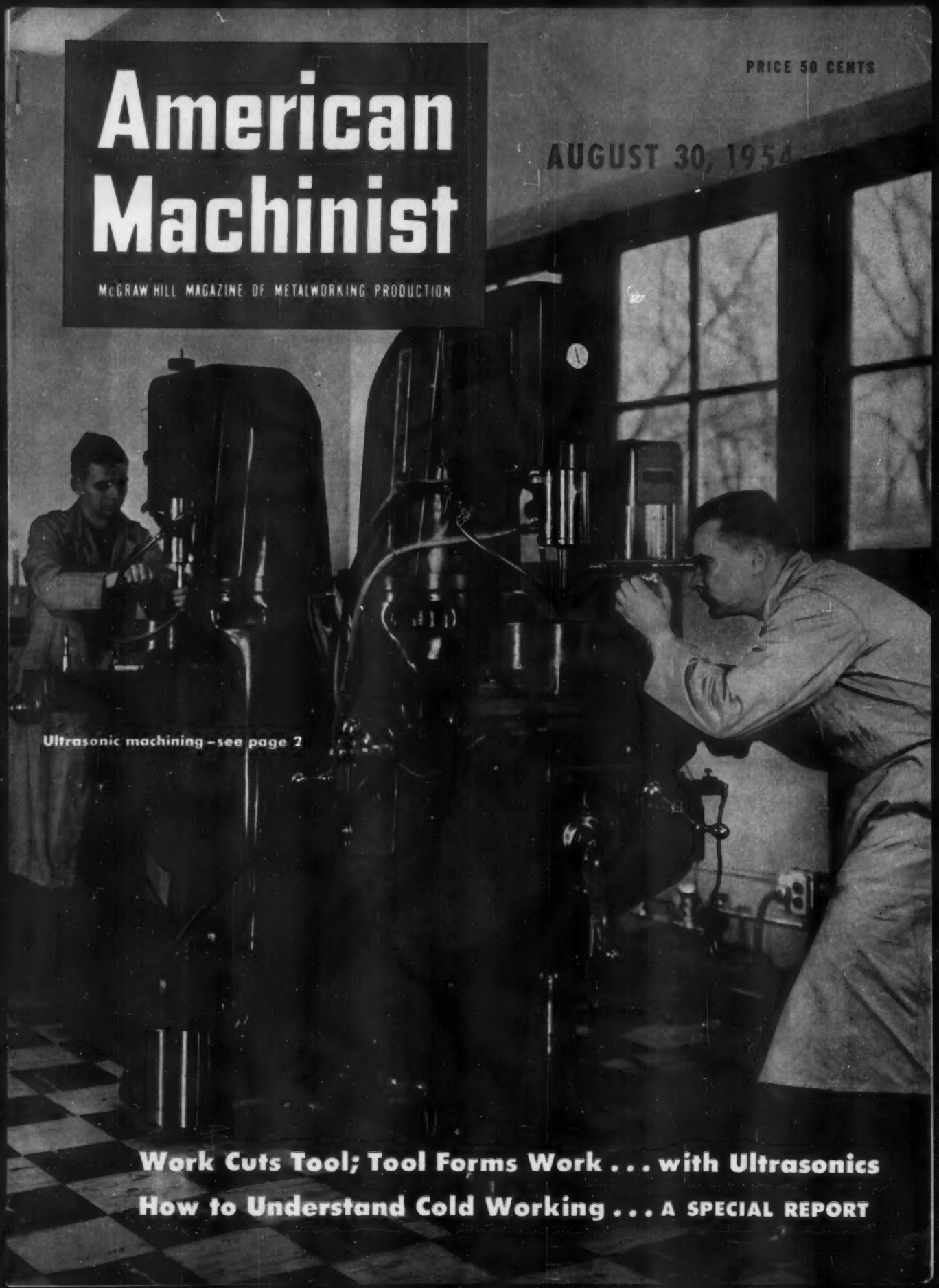
American Machinist

McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

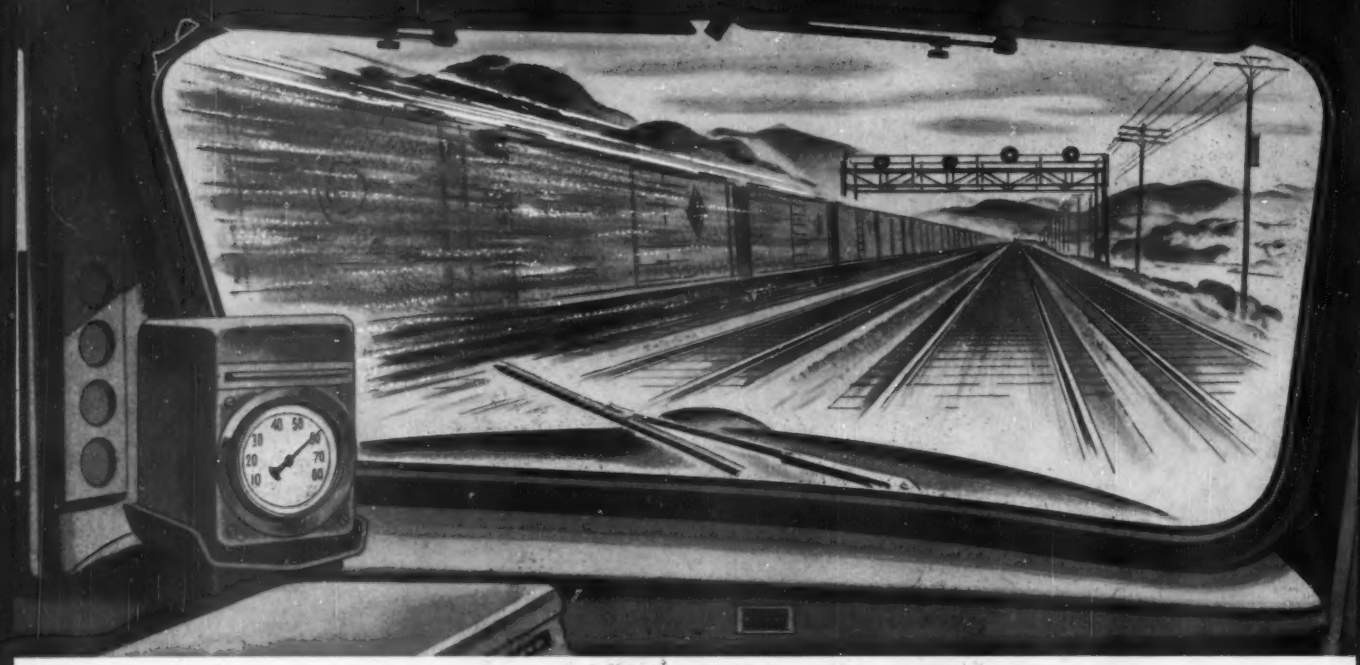
AUGUST 30, 1954



Ultrasonic machining – see page 2

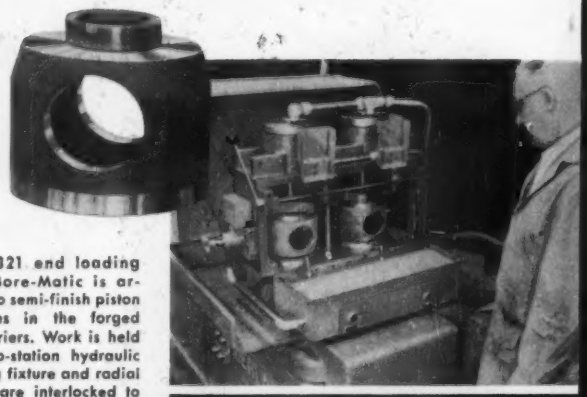
Work Cuts Tool; Tool Forms Work . . . with Ultrasonics

How to Understand Cold Working . . . A SPECIAL REPORT



10,000 TONS AT A MILE A MINUTE!

... it will get where it's going a little sooner, a little safer, because this part got the FULL HEALD TREATMENT

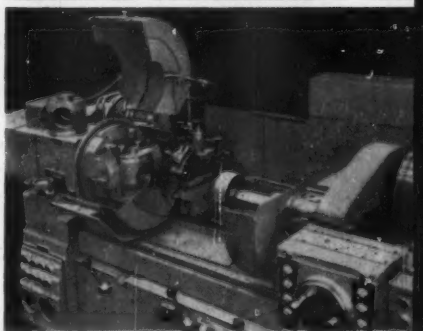


You're hitting the high iron at 60 per, with ten thousand tons of fast freight behind you. The huge, smoothly-purring diesels at your command have ample power and stamina to pull this tremendous load for hundreds of miles—with no interruptions, no unscheduled stops.

The tremendous power and long-haul dependability of modern diesel locomotives are a tribute to the skill and ingenuity of their makers. And precision finishing on Heald machines adds much to the stamina and perfect functioning of many vital diesel parts. Here, for example, is a piston pin carrier that is processed on *all three* basic Heald machines—as shown at the right.

Whenever a part is precision finished on Heald equipment you can be sure of three things. A finer, longer-lasting, precision made part. Important savings in time and production cost. A definite competitive advantage for your product. That's why IT PAYS TO COME TO HEALD.

Model 321 end loading Heald Bore-Matic is arranged to semi-finish piston pin holes in the forged steel carriers. Work is held in a two-station hydraulic clamping fixture and radial locaters are interlocked to insure proper location before machine is started.



Model 272 Gage-Matic Internal finish grinds the piston carriers. The work is held in an angle plate fixture with hand clamping; location is by pins in locating holes in piston carrier skirt. Workhead spindle positioning units are furnished so that loading will be from one position at all times.

Model 261 Rotary Surface Grinder finishes the shoulder of the piston pin carrier to provide flat smooth surface for locating on the inside dome of the diesel piston. The work is held on a radial pole magnetic chuck with a retainer ring. Machine operates on a standard operating cycle.

THE HEALD MACHINE COMPANY

WORCESTER 6, MASSACHUSETTS

Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York

American Machinist

MAGAZINE OF METALWORKING PRODUCTION

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chips

ULTRASONICS . . . Two years ago (*AM*—Sept 15, '52, p 141) we brought you first details on ultrasonic cutting of hard materials. To bring you up to date, our current cover pictures, in four colors, two new Sheffield Cavitron machines. They're cutting one of four rectangular ports in an aircraft hydraulic valve. Tolerances: hole spacing 0.0005 in., slot width 0.0005 in., length 0.001 in. Precisionaire Plunjet gages control table indexing. The near operator is at the moment checking amplitude of vertical oscillation of the toolholder (23,000 cps) . . . Further to bring you up to date, our lead article shows high spots in the making of typewriter and adding-machine type segments at Remington-Rand, Elmira, N. Y. Included are practical applications of ultrasonic machining in making carbide dies for "kneading" type and glass matrix plates, with some interesting savings.

TREPANNING TI . . . At Watertown Arsenal, trepanning large titanium cylinders is saving a core worth about $1500. The changes in method necessary to adapt trepanning to titanium are described by S E Sieman and Nicholas Rosato of the laboratory machine shop at Watertown.

MORE ON MACHINING TI . . . Pontiac Div of GM has been doing some machining on titanium parts, has found conventional practices work, with a few variations. Roland Satterlee, supt (see biog), tells the story in a 4-page article, using an M39 gun part as a case study.

COLD WORKING . . . Sam Storchheim is with us again, this time to tell about cold working. In eight tight pages, he tells how to understand what happens in the process, making our current Special Report.

BABBITT . . . Once, practically all bearings were babbitt, and any shop man knew how to rebabbitt a bearing. Now there are so many other types that many men don't know how to remake a sleeve bearing. So we give you the step-by-step story from Consolidated Edison; you'll have it if and when you need it.

CONTROLLED CONDITIONS . . . J A Hudson, supervisor of process development at Saginaw Steering Gear Div, brings us our second GM article in this issue, one on purifying hydraulic-test oil for power-steering units. Sharples centrifuges and Barnesdril magnetic separators keep contamination down to 5-micron size.

MACHINING DOWN . . . By changing from sand-cast to continuously cast bronze bars, American Smelting & Refining Co improved tool life and cut production time. We tell the story in a quick page.

COMING . . . More on titanium (two articles), Special Reports on blanking miniature parts of mica and on annealing, plus articles on scheduling, drilling, and even on pinball machines—these will keep you on your toes in Sept 13 *AM*. The cover shows a new, big, planer-type miller, and there's another instalment of Stanley Cope, too.

GUNMAKER . . . Roland C Satterlee, superintendent of the M39 Gun Plant at Pontiac Motor, has been with General Motors since 1929. His experience at Pontiac has included supervisory positions in both commercial and defense work. He, at present, heads production of the 4.5-in. rocket, the transmission for the amphibious cargo carrier, and the M39 aircraft cannon. Born and educated in Traverse City, Mich, he is a member of the Pontiac Chamber of Commerce and of the Pontiac BPOE Lodge 810.

Pinion carrier for an aircraft planetary reduction gear.
Impeller shaft for aircraft supercharger.
The Gleason No. 26 Quenching Press for parts up to 25″ in the maximum dimensions.
The Gleason No. 140 Quench Machine for shafts and similar parts 5/16″ to 4″ in diameter, up to 43″ in length.
Aircraft cam gear.
Breech block for an automatic rifle.

How to hold parts like these to close tolerances during quenching

Are you troubled by warpage or distortion of precision parts during hardening?

If you have this problem, Gleason Quenching Equipment can help solve it with substantial savings in costs.

This equipment provides automatic, controlled quenching of flat, round, irregular, or shafted parts insuring alignment and minimizing distortion.

For round, flat or irregular parts up to 36″ in the maximum dimension there are three sizes of Gleason Quenching Presses of the type shown at the top right.

For shafts or similar parts there is the Gleason Rolling Quench Machine, shown at lower right. It accommodates shafts from $\frac{5}{16}$″ to 4″ in diameter, from 6″ to 43″ in length, and can handle parts with integral cams, gears or shoulders up to 8″ in diameter.

In all these machines the heated part is held under pressure. Flow of the quenching fluid to each portion of the heated part is accurately controlled at preset rates during all stages of the quenching cycle.

In the Quenching Presses precision dies hold the part in alignment and direct the flow of quenching medium during the quenching cycle. In the Rolling Quench Machine the part is rolled under controlled pressure. Relative pressures applied to the various portions of the part are accurately and automatically controlled.

The use of Gleason Quenching Equipment eliminates the need for any subsequent straightening. This is important for two reasons: (1) It saves one operation, reducing production costs. (2) Hardened parts which do not require straightening have less residual stress. Further information will gladly be sent on request.

GLEASON WORKS

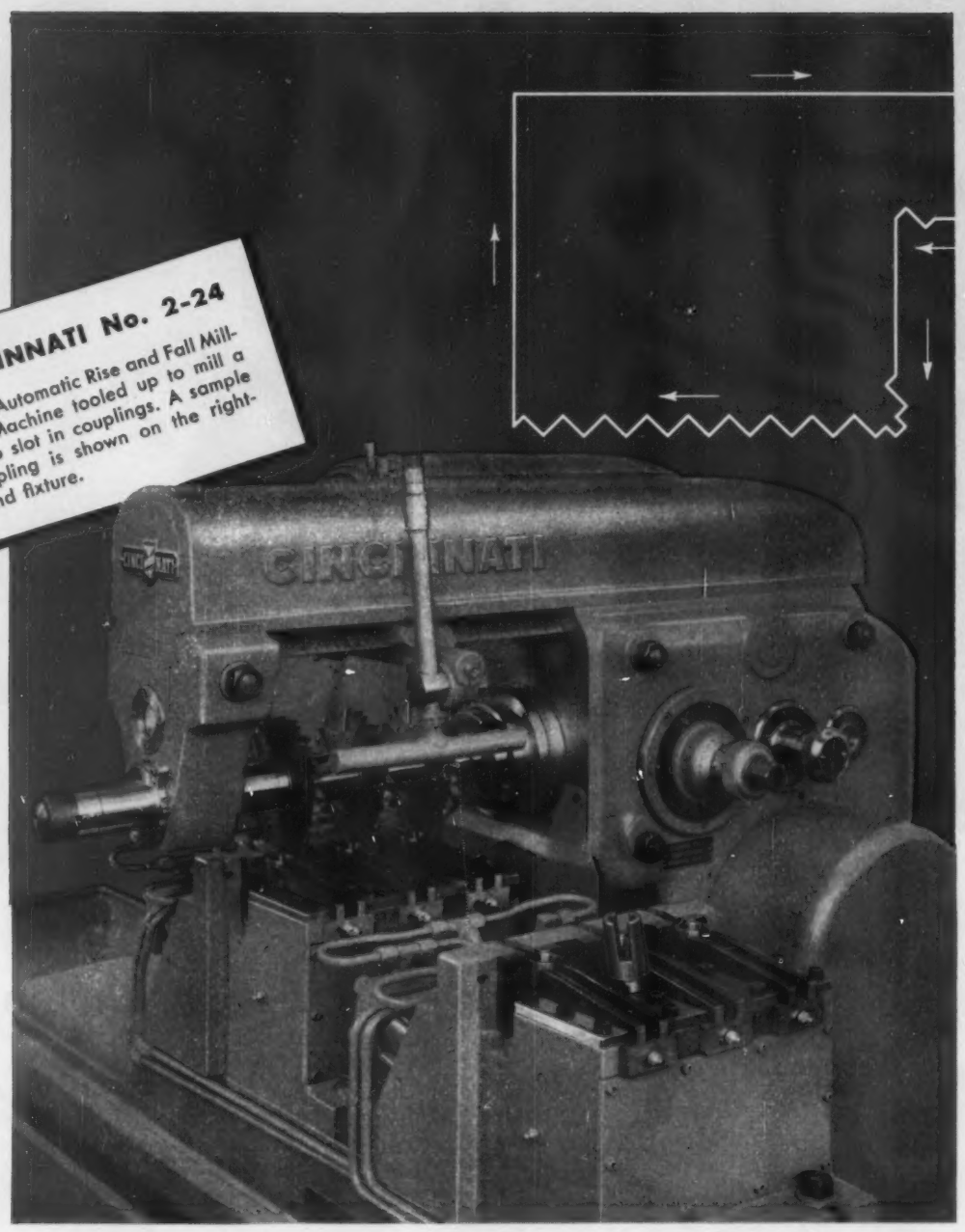
Builders of bevel gear machinery for over 85 years

1000 UNIVERSITY AVE., ROCHESTER 3, N. Y.

See these machines in Booth 454

AT THE NATIONAL METAL EXPOSITION

Chicago November 1-5, 1954

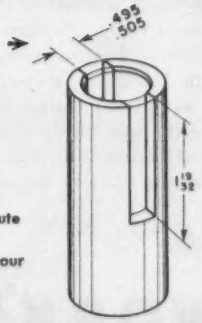


CINCINNATI No. 2-24

Plain Automatic Rise and Fall Milling Machine tooled up to mill a deep slot in couplings. A sample coupling is shown on the right-hand fixture.

Drawing of part and production data:

Part name	Coupling
Material	Steel
Stock removal	From solid
Cutting speed	76 feet per minute
Feed	3½ inches per minute (one cut)
Production	112 couplings per hour



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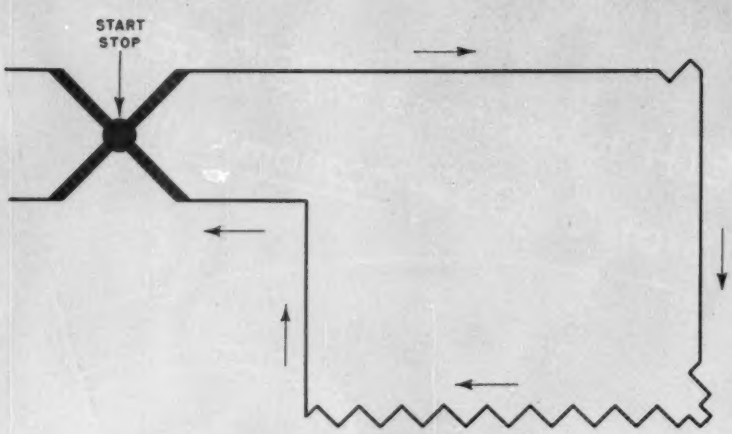
MILLING MACHINES • CUTTER SHARPENING MACHINES • BROACHING MACHINES • METAL FORMING

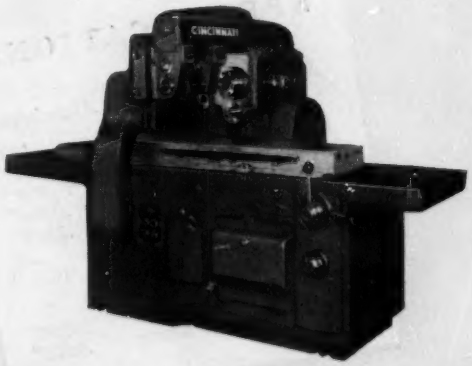


Automatic cycle for a cost-reducing setup on a CINCINNATI No. 2-24 Automatic Rise and Fall Miller.

X means safety of operation for this high production setup

In the two-position automatic milling cycle diagramed here, X indicates complete safety for the operator. It's an automatic stop position for the cutter rotation, table traverse, and coolant . . . giving the operator ample time to safely load and unload the fixtures. This is a standard feature of CINCINNATI No. 2-24 Automatic Milling Machines. ¶ The equipment illustrated is a complete production package by Cincinnati. The milling operation itself, mill ½" slot 1⅝" deep in couplings (see part drawing), is rather simple, but to keep the cost at the very lowest, our Application Engineers chose the Rise and Fall style machine, and equipped it with two three-station hydraulically operated fixtures. The slots in both sets of parts are machined by the "down milling" method, a cost-cutting advantage gained from the machine's Automatic Backlash Eliminator. To jump over obstructions in the fixture, the spindle carrier rapid traverses up and down, synchronized with the table traverse from one position to the next. An automatic stop position at the center of the cycle provides complete safety for the operator. ¶ Whether your milling operations are simple or complex, you can do them better and at lower cost on a CINCINNATI. For brief data on the No. 2-24 line, look in Sweet's Machine Tool Catalog. Complete information may be obtained by writing for catalog No. M-1760.

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO

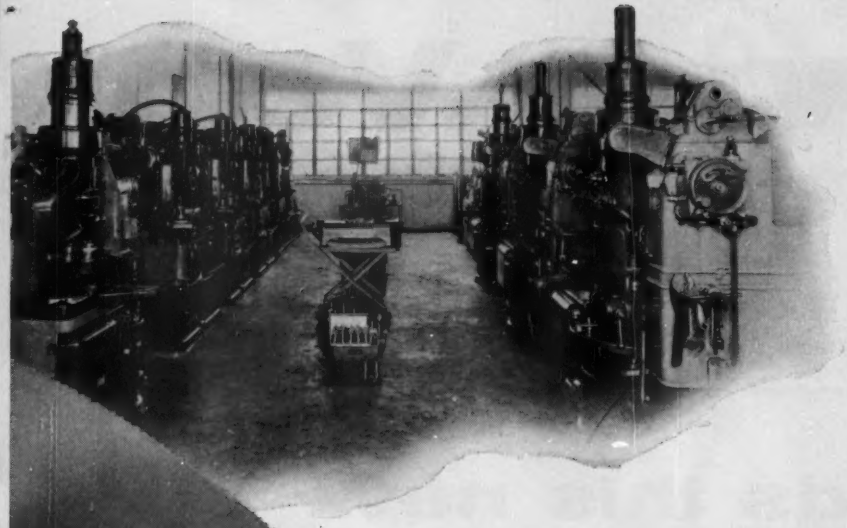


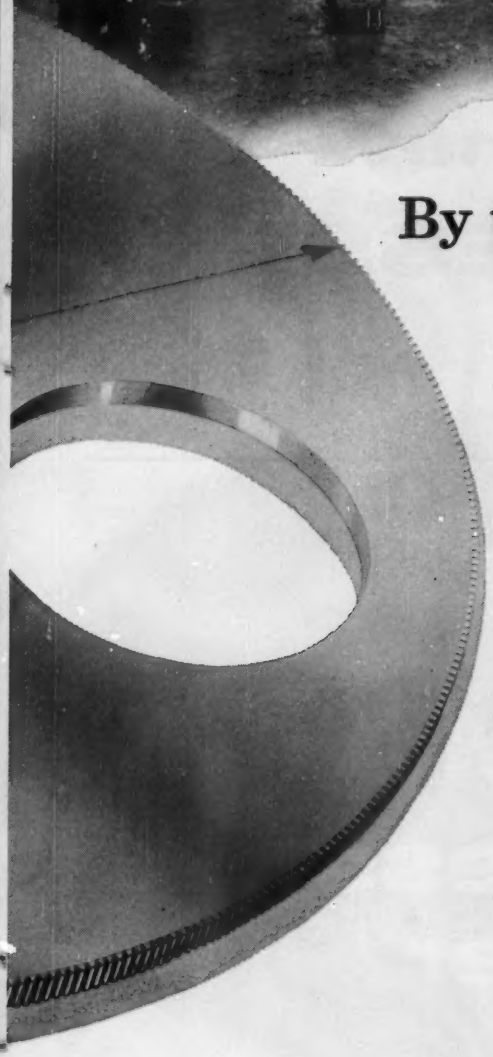
CINCINNATI No. 2-24 Plain Automatic Rise and Fall Milling Machine. Catalog No. M-1760.

NATI

MACHINES • FLAME HARDENING MACHINES • OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID

468 FINE PITCH TEETH to be cut on a 9.7917 GEAR
to P.D. TEST LIMITS of .0005" — economically
Scale: 1"=1"
9.7917"
SPECIFICATIONS
Material 24 St. Aluminum
Number Teeth 468
Outside Diameter 9.7917-9.7897"
Pitch Diameter 9.7500 + .000 − .0005"
Face Width .1875"
Diametral Pitch 48
Pressure Angle 14½°
Tooth to Tooth Composite Error .0003"
Total Composite Error .0005"
Fellows





By the FELLOWS Method!

A job, most certainly for a super precision gear shop . . . actually from a No. 1 contract gear plant in Florida.* It is shown here because gear men will appreciate the problem of holding .0005" limits on a blank of this size and design.

"CUT ON A FELLOWS 645A3 GEAR SHAPER—SHAVED ON A NO. 12 FELLOWS SHAVING MACHINE" is part of the story. Add the set-up skill of experienced operators as an obviously important contribution. But never overlook the significance of tooling with ORIGINAL FELLOWS CUTTERS and FELLOWS-MADE SHAVING TOOLS.

If you would cut good gears and hold to consistently low costs, draw a Fellows Sales Engineer into consultation. No obligation, of course. Catalogs on request. Address the nearest office.

**Frohman Manufacturing Co., Miami, Florida*

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Now... Van

adds this new

CRUSH-DRESSER

to the

VAN NORMAN

Manufacturers of — Ram and Column Type Milling Machines, Cylindrical Grinders, Spline Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.

Norman

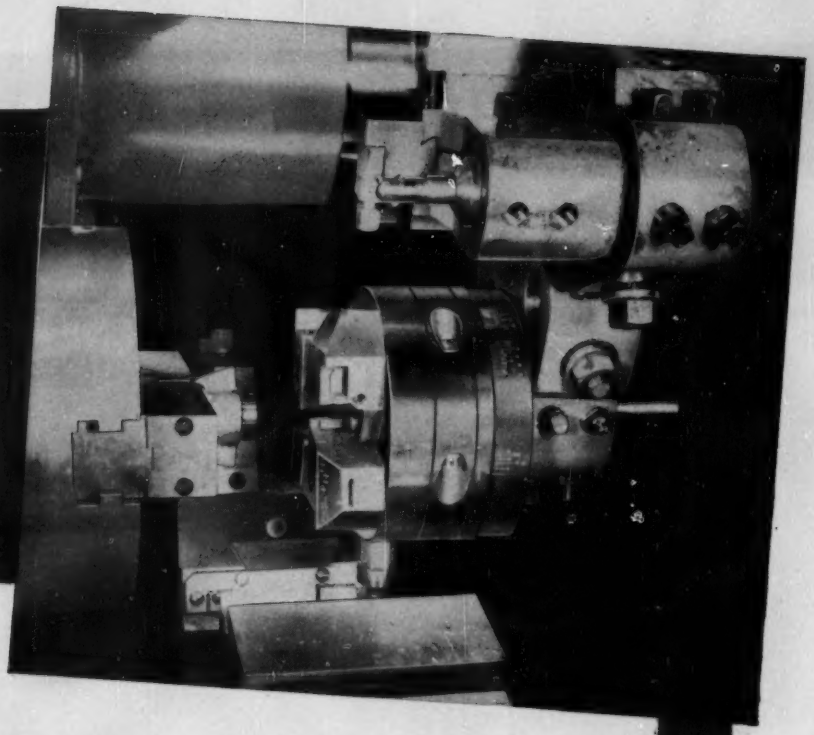
Work Size 0-1½' Diam.
Grinding Wheel 14" O.D. x 4" Wide.
Regulating Wheel 8" O.D. x 4" Wide.
Can be used for standard thru-feed and infeed centerless grinding. Automatic cycle optional.

Here's a new Van Norman development that increases the scope of centerless grinding operations . . . the Crush-Dresser attachment.

Many small, formed parts and multi-diameters can be ground direct from the solid on the Diversimatic with the Crush Dresser Attachment. It dresses the wheel to the desired contour and holds the form hundreds of pieces between wheel dressings, imparting the exact profile to the work. Also finish grinds rough-turned parts. Grinds faster, holds tolerances, cuts costs. Write for full details about the Diversimatic, today.

COMPANY SPRINGFIELD 7, MASSACHUSETTS, U.S.A.

LANDIS
Machine
COMPANY
WAYNESBORO • PENNSYLVANIA
THE WORLD'S
LARGEST MANUFACTURERS OF THREAD



The adaptability of Landis Heads is once again proven by this application of a LANDMATIC Head on a #1AC Warner & Swasey Automatic Chucking Machine. Normally, the LANDMATIC is applied to turret lathes and while self-opening, it is closed manually. To adapt this stationary head for automatic operation on the Automatic Chucking Machine, only two steps were required: (1)—the addition of a closing roller in place of the handle and (2)—the use of special closing pins which provide overtravel, eliminating the need of a complicated, accurately-set closing cam.

This adaptability has paid off for the S&C Electric Company, Chicago, Illinois, manufacturers of high voltage protective equipment.

Besides a completely automatic threading operation, this head, through the use of long life tangential chasers, offers lower tool cost and less down time. For example—when threading the workpiece shown, a contact ferrule of 85-5-5-5 cast red brass requiring a 1⅜"—16 Pitch UN thread ⅜" long into a 1/16" relief, complete runs of over 3000 pieces are made without grinding the chasers.

Another outstanding feature of LANDMATIC Heat-Treated Heads is their wide range coverage and oversize capacity. The 2" Head, illustrated here, will normally thread all diameters ranging from ⅜" to 2". Using oversize chaser holders, its range can be increased to thread up to 3¾" in diameter.

For more complete information on LANDIS Heat-Treated Heads for rotary or stationary applications, straight or tapered threading, ask for Bulletin F-90. Please send specifications when writing.

Completely Automatic Operation

- Landis No. 12½ Centerless Grinder
- Automatic Loader and Unloader
- Automatic Grinding Cycle
- Automatic Wheel Dressing

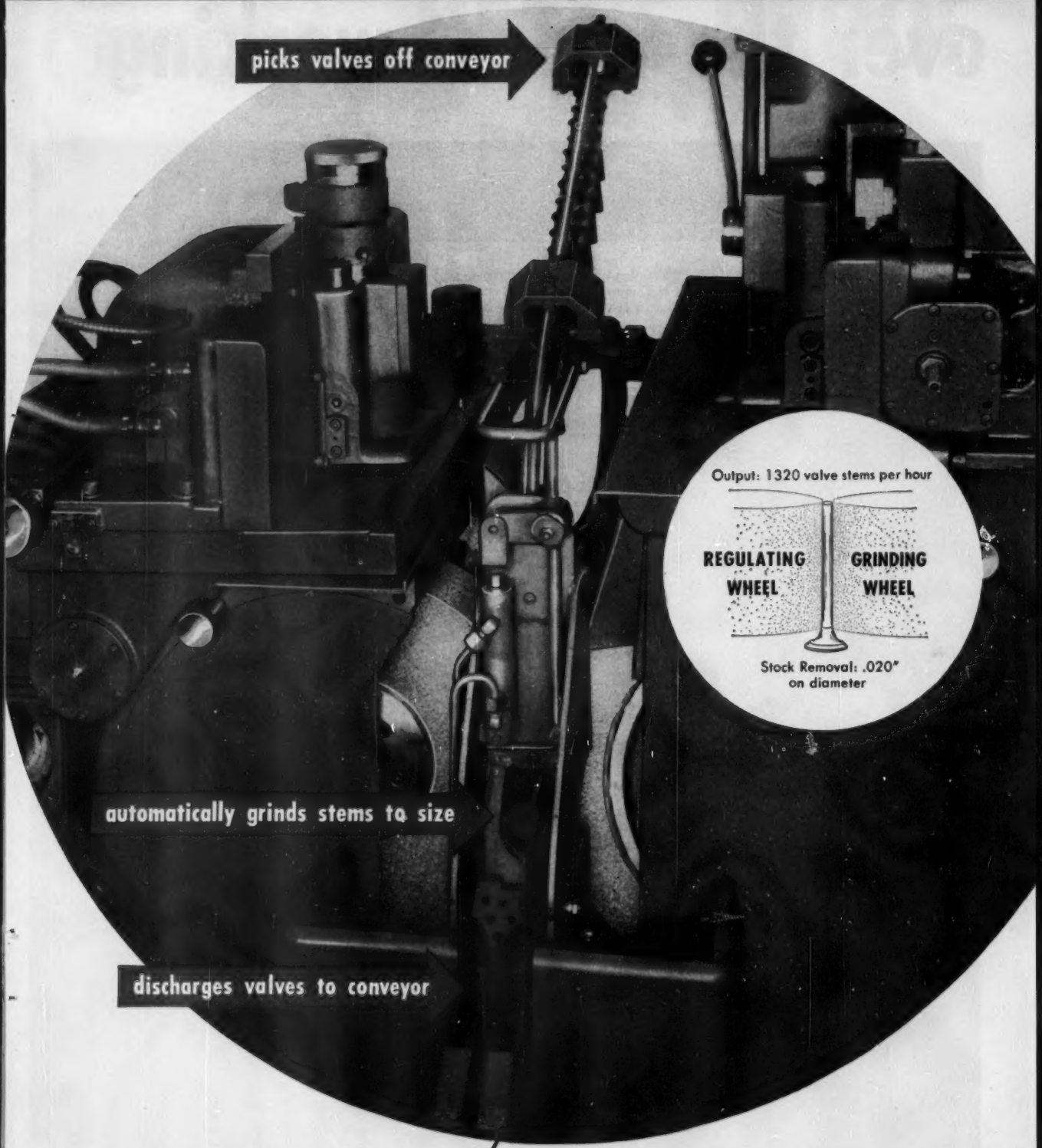
This new Landis No. 12½ Centerless grinder now makes possible reduced grinding costs for work up to 6" diameter. Automatic operation, like this example, can reduce your grinding costs. Send your data for production estimates.

LANDIS

precision grinders

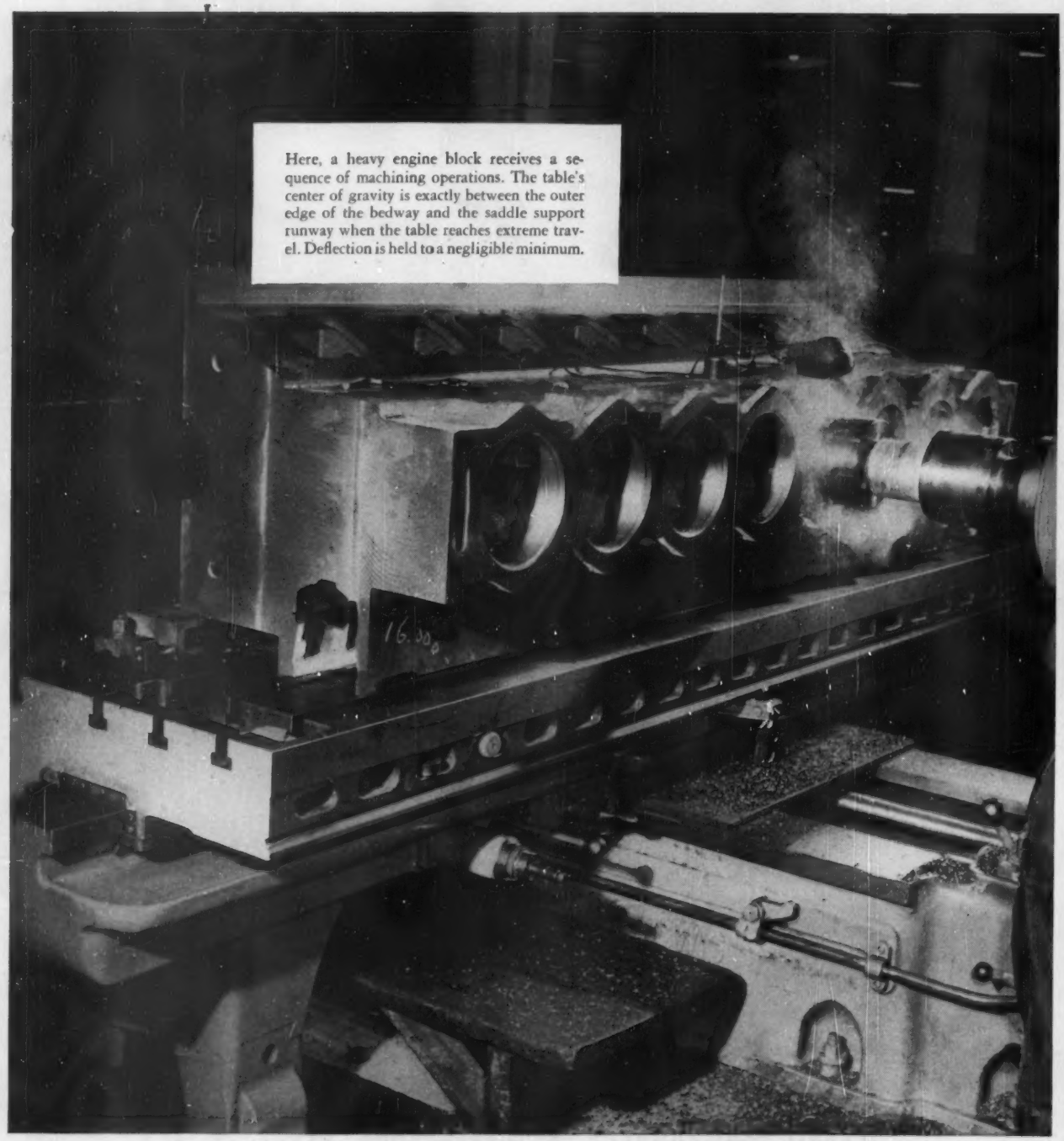
180

cuts centerless grinding costs


picks valves off conveyor
Output: 1320 valve stems per hour
REGULATING WHEEL
GRINDING WHEEL
Stock Removal: .020" on diameter
automatically grinds stems to size
discharges valves to conveyor

LANDIS TOOL COMPANY / WAYNESBORO, PENNA., U. S. A.

G&L 30 Series offers over the widest working



Here, a heavy engine block receives a sequence of machining operations. The table's center of gravity is exactly between the outer edge of the bedway and the saddle support runway when the table reaches extreme travel. Deflection is held to a negligible minimum.

you greatest precision ranges...HERE'S PROOF

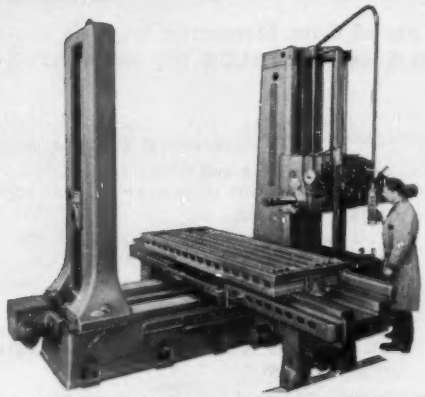
Extended saddle, saddle supports and auxiliary runways are available with G & L 30 Series Table Type Horizontal Boring, Drilling and Milling Machines. This exclusive method of supporting the table takes the risk out of precision-machining large workpieces requiring full range of the machine.

A *fully-supported,* extended saddle is absolutely vital when a long table and high columns are used to precision-machine a sequence of different surfaces on a heavy workpiece. The G&L design incorporates an extended saddle that minimizes deflection and is provided with full support even when the table is at its outermost travel limits.

What's more, G&L has engineered a system of concentric leveling (see lower right) which insures perfect alignment and parallelism between rails, saddle supports, saddle and table.

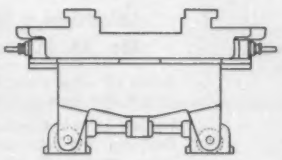
These are only a few of the many advantages you get with a modern G&L Horizontal. A selection of many other standard and optional features gives you the exact machine you need — a machine that's unsurpassed for accuracy, capacity, simplified operation and years of outstanding performance.

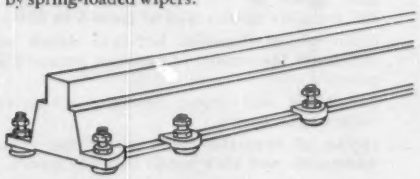
For complete details, see your G&L representative or write for catalog No. 30.



G&L 30 Series machines are available in two basic models — the 350-T (shown) with a 5" spindle and 25 hp, and the 340-T with a 4" spindle and 20 hp. Note how the under-the-floor runways allow the operator to perform his job without having to climb over the machine.

Adjustable brackets with hardened and precision-ground steel rollers. Located one to each support leg, they engage hardened and ground steel rails, are protected by spring-loaded wipers.



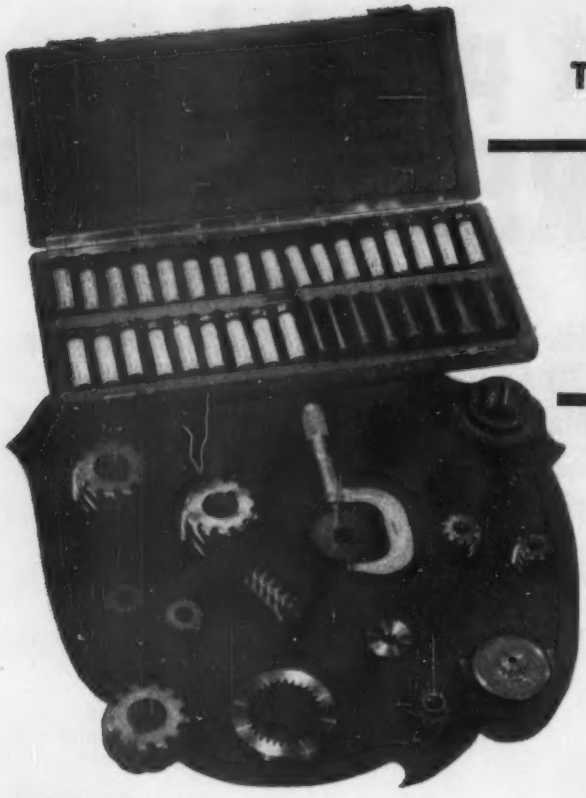


On runway, large diameter adjusting screws are threaded through flange and drilled to receive foundation bolts. Rails are sunk into foundation so tops are even with floor level. Rails and machine are separately leveled and saddle support brackets adjust independently.

Builders of the world's finest heavy-duty machine tools — Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; Hypro Double Housing and Openside Planers; Planer Type Milling Machines and Vertical Boring Mills; and Davis Cutting Tools.

GIDDINGS & LEWIS MACHINE TOOL CO.

FOND DU LAC, WISCONSIN



THE *Van Keuren* GEAR MEASURING SYSTEM

Set 26EX—Gear Measuring Wires, accurate to ± .000025", for common diametral pitch external spur gears.

VAN KEUREN GEAR MEASURING WIRES PROVIDE THE MOST ACCURATE AND LOW COST METHOD OF MEASURING THE TOOTH THICKNESS OF SPUR AND HELICAL GEARS, INVOLUTE SPLINES AND INVOLUTE SERRATIONS.

ONLY . . . *EQUIPMENT NEEDED:*

1—SET VK MEASURING WIRES
1—MEASURING INSTRUMENT

Complete information regarding the use of Gear Measuring Wires is contained in a 50-page section of the Van Keuren CATALOG and HANDBOOK No. 35. Included in this section are:

- **. . . table of wire sizes for the 1.92", 1.728", 1.68" and 1.44" series.**
- **. . . tables of wire measurement including change factors for standard external and internal spur gears of 14½°, 17½°, 20°, 25°, and 30° pressure angles and of from 5 to 500 teeth.**
- **. . . table of relationships between depth of cut and tooth thickness for common pressure angle gears.**
- **. . . definitions and exact formulas covering involute spur gears.**
- **. . . tables of involute tooth parts for standard addendum and stub tooth involute gears.**
- **. . . information, formulas and examples regarding the wire measurement of helical gears.**
- **. . . information and examples concerning the wire measurement of enlarged pinions and reduced gears.**
- **. . . tables of wire measurement for involute splines.**
- **. . . tables of wire measurement for involute serrations.**
- **. . . tables of comparative measurement over three sizes of wires for use in involute profile checking.**

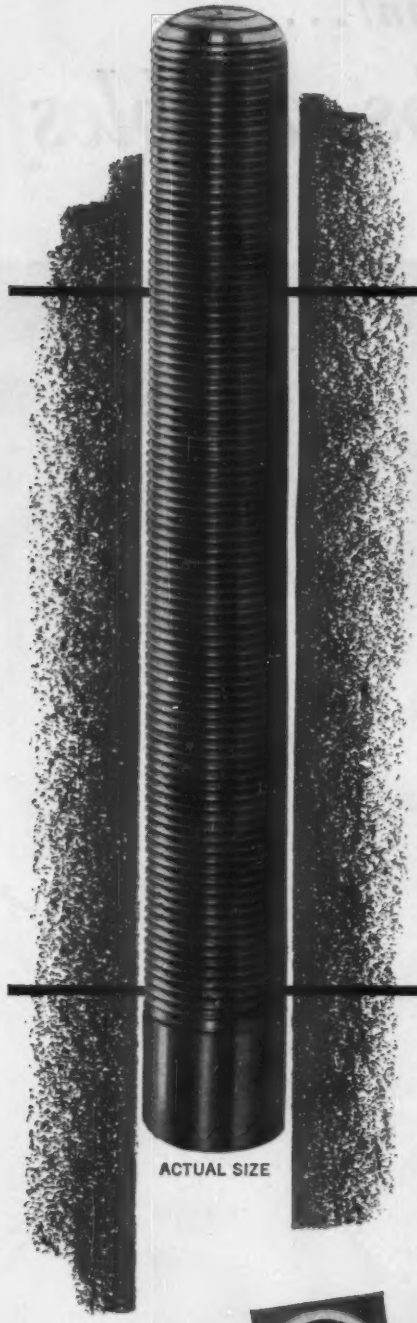
CATALOG and HANDBOOK No. 35 is available without charge by writing to: The Van Keuren Co., 173 Waltham St., Watertown, Mass. Ask for your copy.

VK
35th YEAR

THE *Van Keuren* CO.,

173 WALTHAM STREET, WATERTOWN, MASS.

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Cemented Carbide Plug Gages • Carboloy Cemented Carbide Measuring Wires • Chrome Carbide Taper Insert Plug Gages



when the odds don't have it...

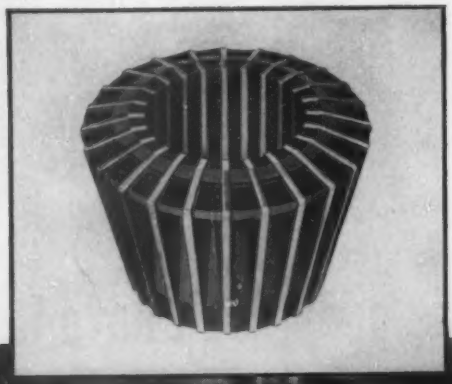
Before putting the chips down it is well to realize that reliable machine performance is largely dependent on well balanced tooling. If it is a multiple spindle bar automatic, an even number of work spindles provides a better opportunity for balance than an odd number.

Odd or even, the work spindles are only one of many important considerations in the selection of an "automatic". Other factors also important to the individual machine user are suggested by the new Conomatic General Datalog. Copies are now available.

data for comparison

Part	**Levelling Screw**
Machine	**1⅝" Six Conomatic**
Tools	**100% Carbide Tipped**
Material	**B-1112**
Stock Size	**1" Round**
R. P. M.	**Work Spindle — 958** **Opposed Spindle — 677**
Time	**7.25 Seconds per Cycle** **3.6 Seconds per Piece**

Conomatic} CONE AUTOMATIC MACHINE COMPANY, INC. WINDSOR, VT., U.S.A.

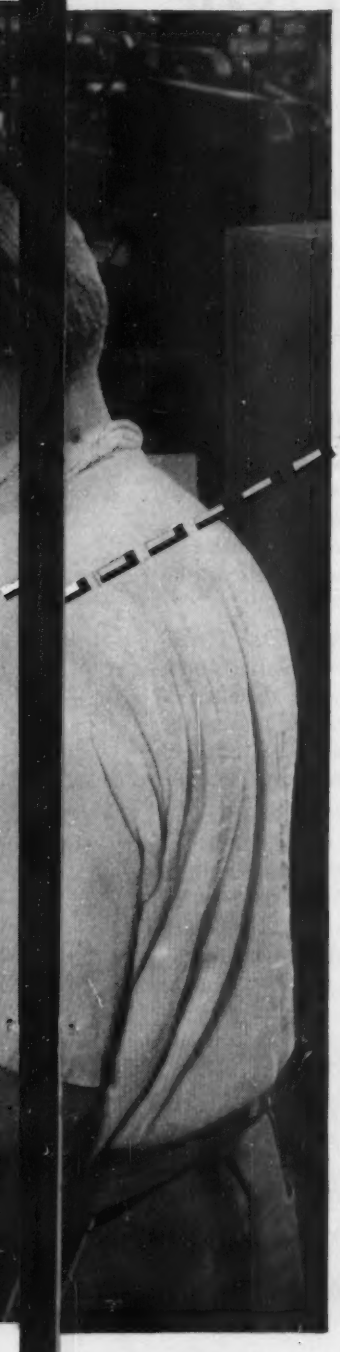


Once again!...

Jacobs doubles

production rate–

grinds 100% faster



Leading chuck manufacturer uses Norton machines to cut grinding time in half

When a leader like The Jacobs Manufacturing Company selects equipment, you can be sure that this equipment has had careful study from every angle of performance and cost.

That's why Jacobs' choice of Norton grinding machines is worth serious consideration when *you* are buying grinding machines.

In producing their famous Rubber-Flex Collets, for example, Jacobs reports that switching from separate operations to a single operation on Norton Type CTU Semiautomatics with multi-wheel mounts has doubled their production rate. *Jacobs reported similar production savings in grinding chuck bodies on the same type of Norton machines.*

Another manufacturer has boosted production from 300 to 600 parts per hour by grinding 2 diameters at once on a Norton machine. Still another reports that a Norton grinding machine with a triple-wheel mount has upped his production rate 128%. Throughout industry, manufacturers are using Norton grinders and lappers to save time, work and money in grinding operations.

Norton Machines in Your Own Grinding bring the same profit-increasing advantages. And remember: only Norton offers you such long experience in both grinding wheels and machines to help you produce more at lower cost.

For further facts, see your Norton Representative, or write us direct. NORTON COMPANY, Machine Division, Worcester 6, Mass. *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5.

To Economize, Modernize With NEW

NORTON

GRINDERS and LAPPERS

Making better products... to make other products better

District Sales Offices: West Hartford • New York (Teterboro, N. J.) • Cleveland • Chicago • Detroit

In the Jacobs Plant. One of the Norton 6" Type CTU Semiautomatic Grinding Machines used by The Jacobs Manufacturing Company of West Hartford, Connecticut, to grind metal inserts in the famous Rubber-Flex Collets. The basically fast action of this Norton grinder, the multi-wheel mount, special swivel table arrangement and wheel-truing device provide a single setup for traverse and shoulder grinding operations that boosts production rate 100%.

The significant results of

THE FIRST 120 DAYS OF

A report by
Francis J. Trecker, President
Kearney & Trecker Corp.

FRANCIS J. TRECKER, *President*
Kearney & Trecker Corporation

JUST four short months ago — as this is written — Kearney & Trecker demonstrated again its leadership in the machine tool industry by pioneering a program, unique among machine tool manufacturers, whereby its products might be obtained on a lease basis, as well as by outright sale or conditional sales agreement.

The results of the Kearney & Trecker TOOL-LEASE program have exceeded even our most optimistic forecasts. It has been a great stimulant of inquiries and new business, particularly where the replacement of worn and obsolete milling and precision boring equipment has been under consideration.

At this time the TOOL-LEASE program has been responsible for several million dollars' worth of new business. The success of this program is ample evidence that our decision to lease was founded on a correct appraisal of the needs of metalworking industry for some way to modernize its plant equipment without delay where working capital for the moment must be used for other purposes. In this respect TOOL-LEASE is serving a practical and

KEARNEY & TRECKER CORPORATION

builders of precision and production

TOOL-LEASE

useful purpose, and we are both pleased and grateful for the acceptance this program has been accorded.

The Kearney & Trecker TOOL-LEASE program today is an integral part of our company's general sales policy. The soundness of the program is evidenced — not only by the 120 day record of leases made by large and small companies alike — but also by the many complimentary letters received from leading figures in almost every executive capacity in business and industry.

Today our sales organization is fully prepared to explain the details of the Tool-Lease program to anyone interested. Briefly, it offers a choice of three basic plans with varying options to continue the lease, terminate the lease or purchase the equipment.

Among the proved advantages of Tool-Lease are: Releases working capital for production expansion. Assures you the services of a machine as long as needed, avoiding risk of obsolescence. Permits user to judge machine's merits in actual shop performance without going to expense of purchasing the machine.

We invite your letters of inquiry. For complete details on Tool-Lease including actual costs . . . for prompt service and assistance in analyzing your plant modernization problems — contact the Kearney & Trecker sales representative in your area.

TOOL LEASE
KEARNEY & TRECKER
MILWAUKEE
MACHINE TOOLS
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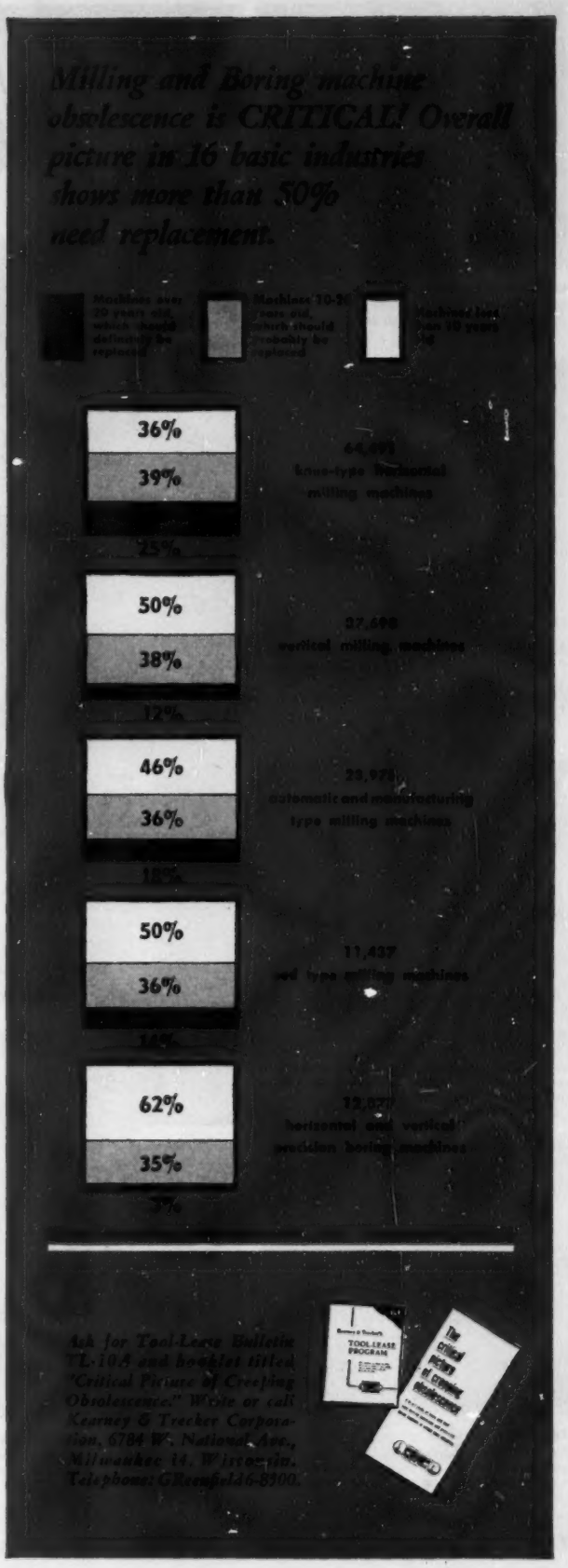
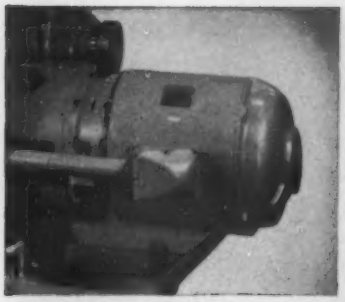
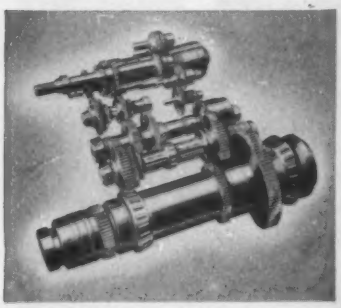
machine tools - since 1898



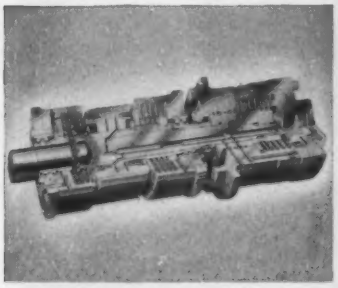
Ask for Tool-Lease Bulletin TL-104 and booklet titled "Critical Picture of Creeping Obsolescence." Write or call Kearney & Trecker Corporation, 6784 W. National Ave., Milwaukee 14, Wisconsin. Telephone GReenfield 6-8900.



MORE POWER—as much as you'll need for any job! Motor range: 2-A, 15 to 40 hp.; 3-A, 25 to 60 hp.; 4-A, 30 to 75 hp.

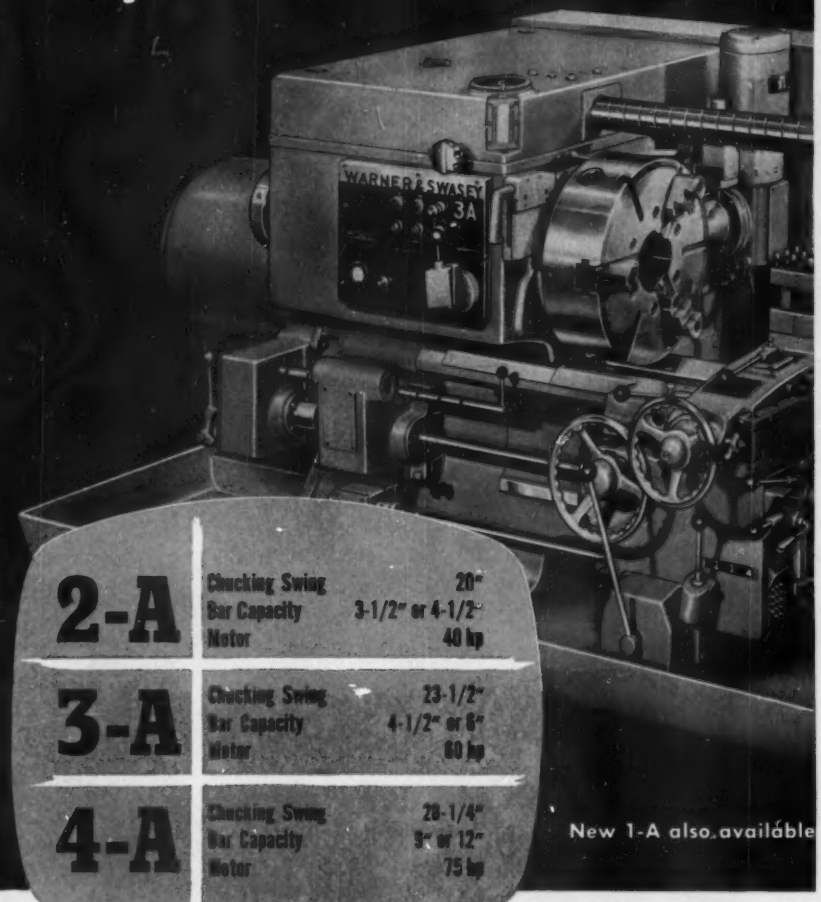


16-SPEED DRIVE provides closer grouping of speeds in natural work range to turn more work diameters more effectively—increase production and tool life. 2-speed motor provides 32 *un-duplicated* speeds!



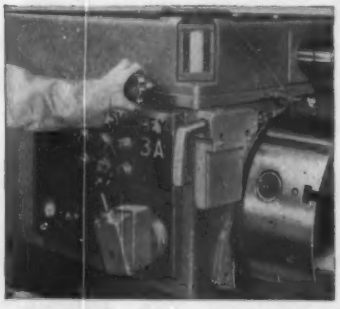
MAINTENANCE-FREE, instant-acting forward and reverse clutch and headbrake unit never needs adjustment—engage smoothly and virtually instantaneously providing fast starts, stops, and reverses.

NEW WARNER & SWASEY INCREASED EFFICIENCY, GREATER

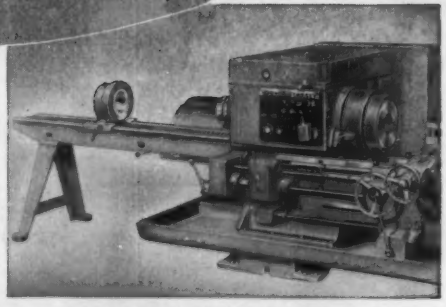


2-A	Chucking Swing	20"
	Bar Capacity	3-1/2" or 4-1/2"
	Motor	40 hp
3-A	Chucking Swing	23-1/2"
	Bar Capacity	4-1/2" or 6"
	Motor	60 hp
4-A	Chucking Swing	28-1/4"
	Bar Capacity	9" or 12"
	Motor	75 hp

New 1-A also available



SPEED PRE-SELECTION made easy by large direct reading indicator dial. AUTOMATIC GEAR SHIFTING boosts production, reduces operator fatigue. A single movement of the control handle without any further attention by the operator slows spindle to crawl speed, then shifts to new speed—all in a matter of seconds.

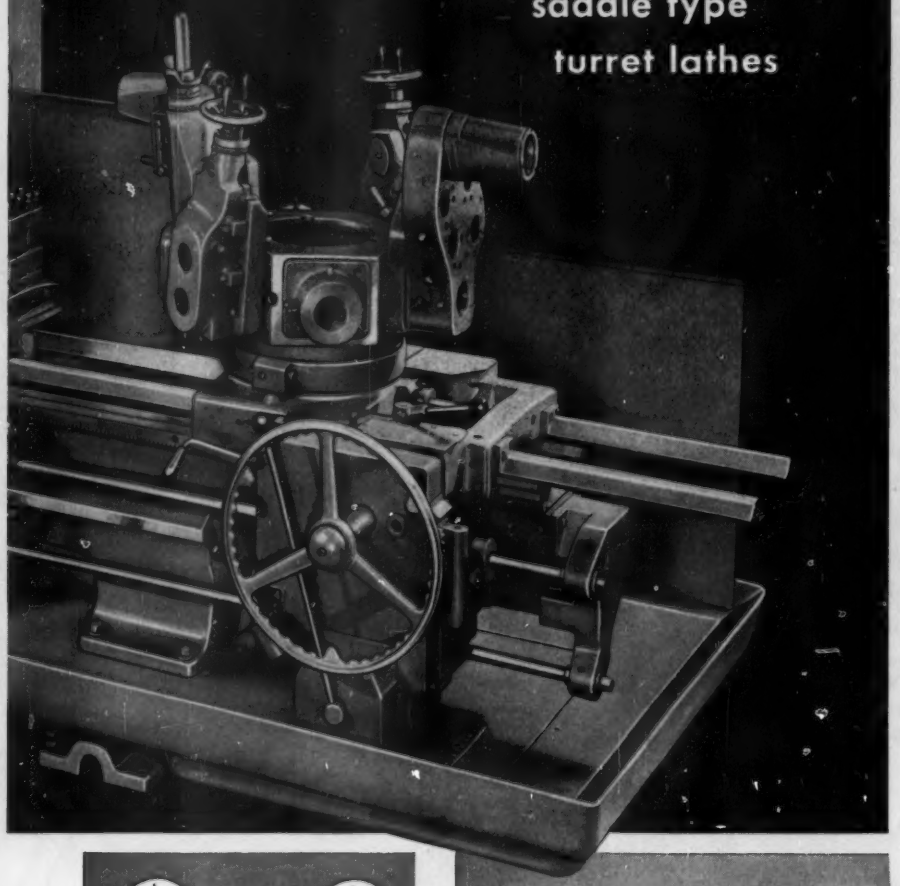


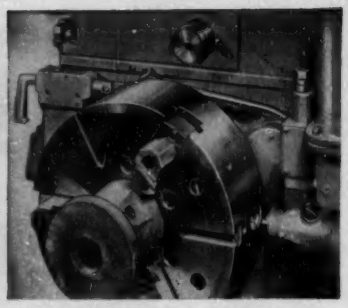
NEW HYDRAULIC CHUCK AND BAR FEED and power return. Provides easier handling, less operator fatigue—increased production.

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS WITH WARNER &

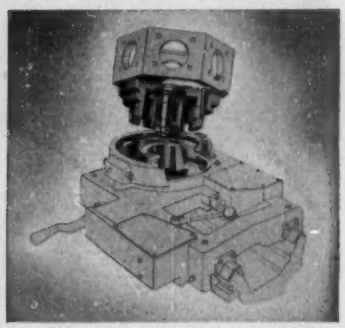
DESIGN FEATURES GIVE YOU PRODUCTION, MORE PROFITS!

A completely new line of saddle type turret lathes

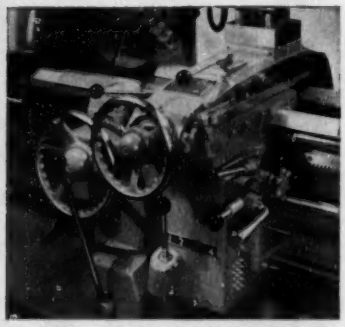




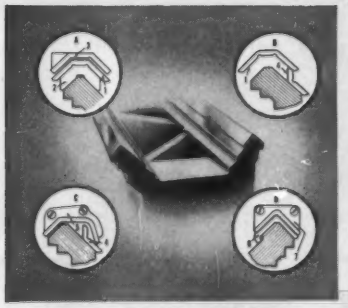
NEW POWER CHUCK WRENCH eliminates back-breaking effort when chucking. Grips and holds delicate work or heavy forgings. Does not obstruct spindle bore.



ACCURATE LOCATING AND LOCKING HEX TURRET assures maintained accuracy. Single lever controls both locating and clamping of turret.



FAST OPERATING CROSS SLIDE. All controls within easy reach. 4-way traversing with rapid traverse lever. Monoshift lever provides fast feed changes. Open type square turret for flexible tooling.



INDUCTION HARDENED VEE-BEDWAYS assure long accurate life. Exclusive way covers protect bearing surfaces from damage by dropped tools, chips, and loss of way lubrication.

INCREASED STRENGTH WITHOUT INCREASED WEIGHT. Scientific diagonal rib design gives over 30% added strength—greater rigidity and long-term accuracy.

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Cleveland
PRECISION MACHINERY SINCE 1880

SWASEY MACHINE TOOLS, TEXTILE MACHINERY, CONSTRUCTION MACHINERY

He scores highest cutting-tool "quiz

...your Morse-Franchised Distributor!

No matter who brings up the tough questions on cutting-tool applications, your Morse-Franchised Distributor has the *right* and *ready* answers. Plus the hard-earned practical experience to go out in your plant with your men and prove the soundness of his recommendations.

Yes, he helps you to get the most for your money out of the finest and most complete line of cutting tools that money can make . . . *the* Morse Line of Drills, Taps, Dies, End Mills, Counterbores and Cutters. So when *you* need the right answers *right now* to a tough problem in cutting tool application, call your Morse-Franchised Distributor. He'll guide you right and save you money . . . *every time.*

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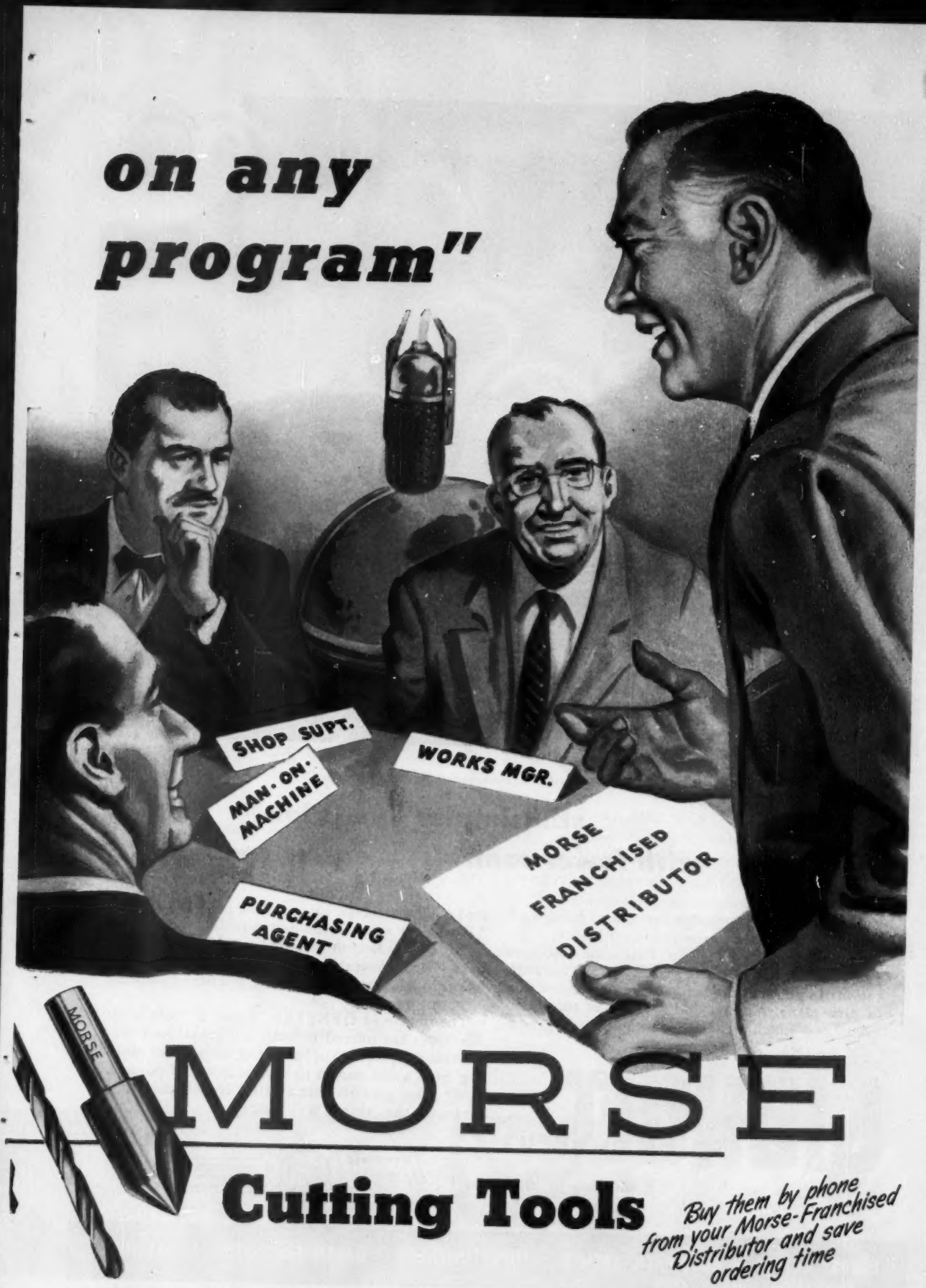
NEW BEDFORD, MASSACHUSETTS
(Division of VAN NORMAN CO.*)*
Warehouses in New York, Chicago, Detroit, Houston, San Francisco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Buy them by phone from your Morse-Franchised Distributor and save ordering time

IMPROVED! GISHOLT type "S" Balancers

still simpler operation
with fewer controls . . . easier readings

Yes, we've made it possible for you to handle all balancing faster and easier than ever before.

On these improved Type "S" Balancing Machines you have but two operating controls, one for indication of amount and location of required correction in each plane. Amount and location of correction are shown simultaneously—on a uniformly graduated scale with large, easy-reading pointer and dial.

These are a few of the new features which years of broad production and maintenance experience have proved desirable. And Gisholt, always first in balancing, is first again to bring you new standards of performance.

The improved DYNETRIC Type "S" Balancing Machines are offered in both horizontal and vertical models, capable of balancing workpieces ranging from a few ounces to several hundred pounds.

Why not get complete details? New literature is yours for the asking. Write today.

GISHOLT MACHINE COMPANY

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TURRET LATHES · AUTOMATIC LATHES · SUPERFINISHERS · BALANCERS · SPECIAL MACHINES

The COLD FACTS about a RED HOT discovery

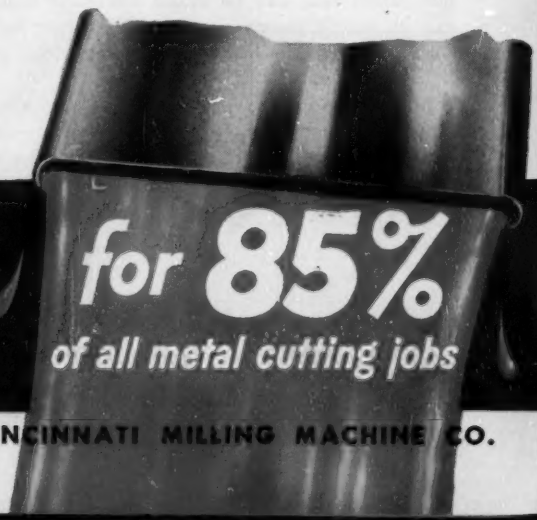
CIMCOOL with "95-59" eliminates rancidity and foul odors

Actual scientific laboratory and shop tests prove—beyond any doubt—that CIMCOOL° with "95-59" eliminates rancidity and foul odors . . . and is positively non-irritating to the skin!

CIMCOOL is giving the cold shoulder to old-fashioned coolants in more and more plants every day because this radically new and different cutting fluid is a *chemical emulsion*. The amazing ingredient "95-59" is a more effective bactericide, is non-corrosive and eliminates rancidity and foul odors—*even in the hottest weather*. And CIMCOOL, in contrast with old-fashioned cutting fluids, can be kept at work longer. Thus, CIMCOOL greatly reduces downtime and labor costs for cleaning and changing.

For a demonstration in your own machines, just write, wire or telephone Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

°Trade Mark Reg. U.S. Pat. Off.



CIMCOOL for 85% of all metal cutting jobs

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

smooth, direct parts flow

for short or long runs

Because of its superior ability to take off center die loads, the Henry & Wright Dieing Machine widens the ways in which you can use the economies of progressive stamping. Add to this basic advantage the accessibility of the H & W Dieing Machine for quick die changes.

Now tie the two together and you have a high speed, low cost production method that affords the maximum degree of flexibility in tooling. Jobs can be completed according to the toughest schedules. Short runs can be mixed with long runs. Assembly tooling can be readily incorporated. Your planning becomes a direct and simple matter of figuring so many completed parts per minute or hour per machine.

Most important, too: you cut your stamping costs below your best expectations and you improve parts quality.

Get the facts about H & W Dieing Machines by writing to Henry & Wright, 481 Windsor Street, Hartford, Conn., for Catalog 54.

HENRY & WRIGHT

DIVISION OF EMHART MFG. CO.

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EXCLUSIVE WIRE-LOKT® CONSTRUCTION

Assures Maximum Safety . . . Low Operating Costs

FAST CUTS
Corrugations speed the grinding of large area work or thin parts without burning.

FINE FINISHES
For light stock removal smooth face discs give quality finishes and close tolerances.

FULL VALUE
The entire rated thickness of the abrasive is usable.

WIRE-LOKT® SAFETY
Heavy steel mesh securely imbedded in the abrasive assures maximum safety.

117A

Gardner Abrasive Specialists give you the advantages of long experience gained from making *both* grinding machine and abrasive discs. Individual specifications will be developed to handle *your* particular grinding job.

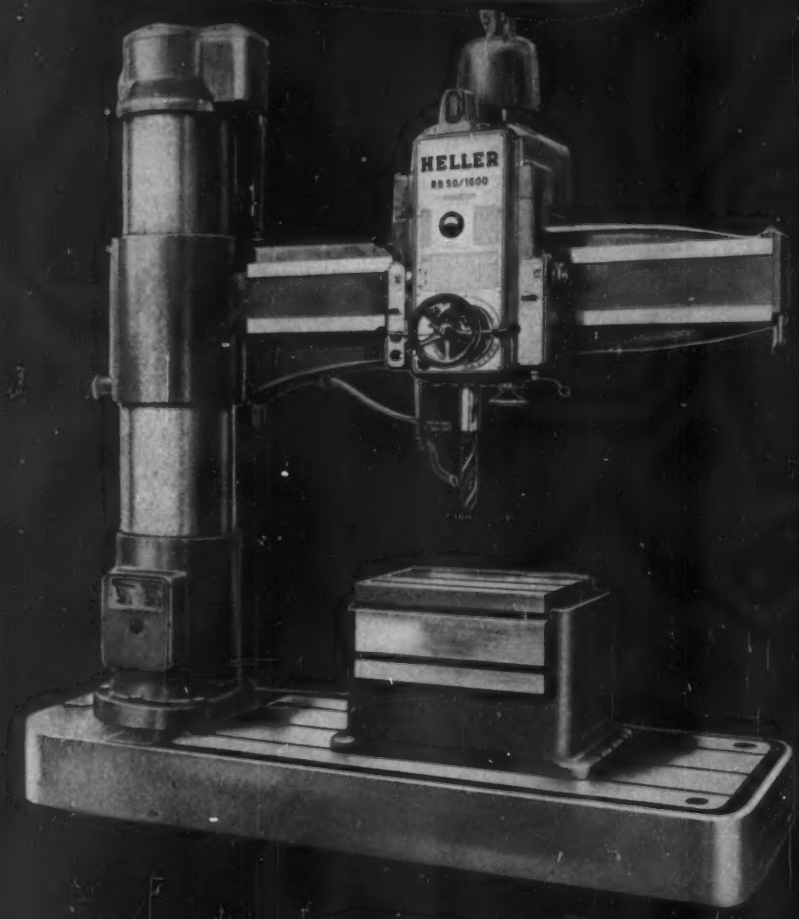
GARDNER MACHINE COMPANY
410 Gardner St., Beloit, Wisconsin, U.S.A.

GARDNER
abrasive discs

Cut Costs and
Increase Efficiency with

HELLER

RADIAL DRILLING MACHINES



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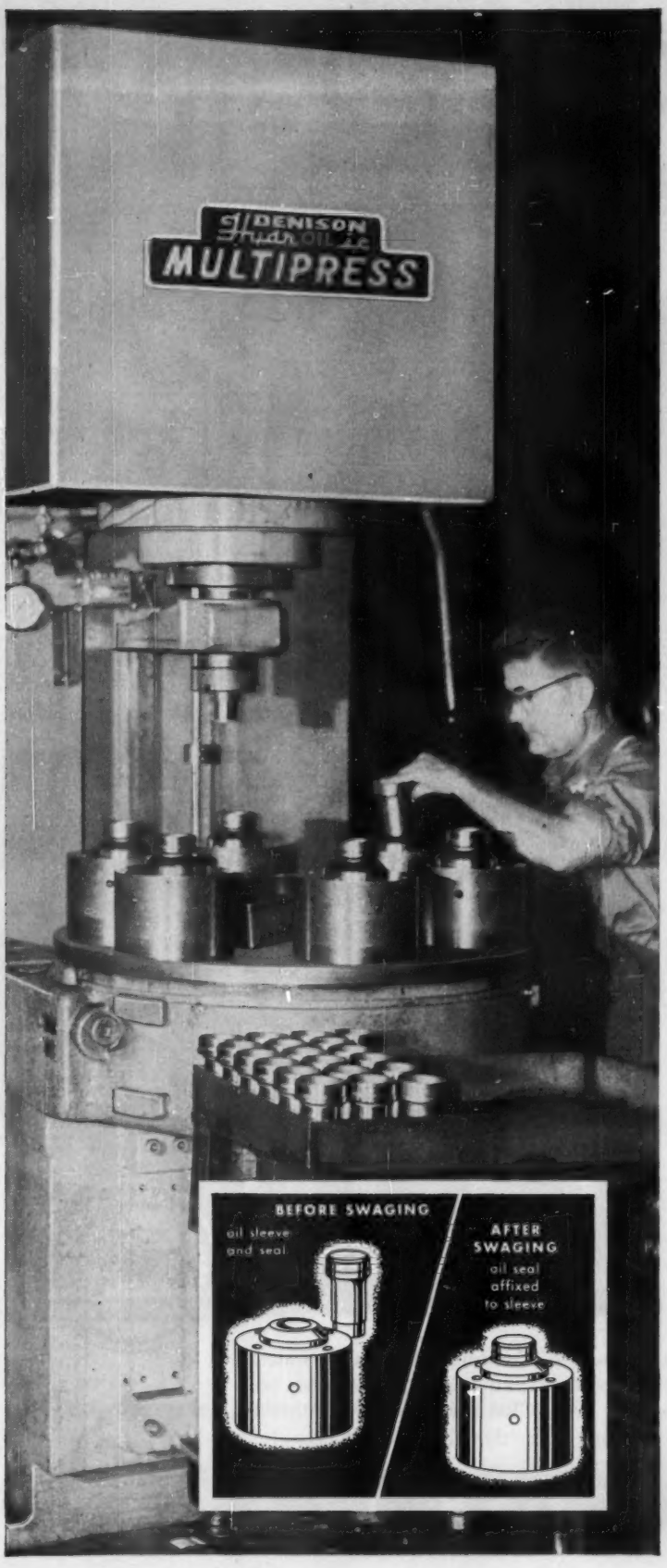
KNEE & PLANER TYPE MILLING MACHINES
COLD SAWING MACHINES • SAW SHARPENING MACHINES • SAW BLADES • TRANSFER MACHINES • SPECIAL MACHINES

Heller Radial Drilling machines are offered in 2½ foot, 4 foot and 5 foot arm types. Column is 16" in diameter and drive is by direct motor through multi-disc friction clutch. Gear change is simplified through preselector unit with automatic depth drilling and tapping switch. Arm raising and lowering and saddle adjustment is hydraulically locked as desired. Construction is complete with anti-friction bearings with special oil pump for saddle lubrication. In addition to Radial drills, we offer also Column Drilling Machines and Gang type drilling machines.

Importing Heller Machines Since 1926



Hired for one job— this DENISON MULTIPRESS® does 21 more

INTERCHANGEABLE tooling and an accurate, fast-acting Denison Index Table make it possible.

This 75-ton Denison hydraulic Multipress with six-station Index Table handles 22 swaging jobs for Mechanics Universal Joint Division, Borg-Warner Corporation.

For setup, the operator simply changes punches. The Denison Index Table, hydraulically interlocked with the Multipress ram, indexes from 10 to 70 times a minute . . . maintains limits of plus-or-minus two-thousandths.

This application—ring-swaging oil seals for universal-joint assemblies—shows what Multipress can do. Replacing a punch press, Multipress raised production 36 per cent . . . lowered labor costs 30 per cent.

Denison Multipress combines speed, accuracy and safety for swaging, testing, assembling and many more applications in the 1-to-75-ton pressure range. For bulletins, write to:

THE
DENISON ENGINEERING COMPANY
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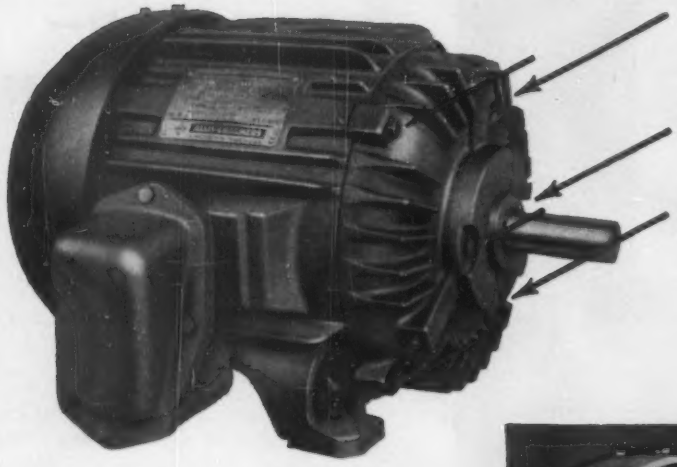
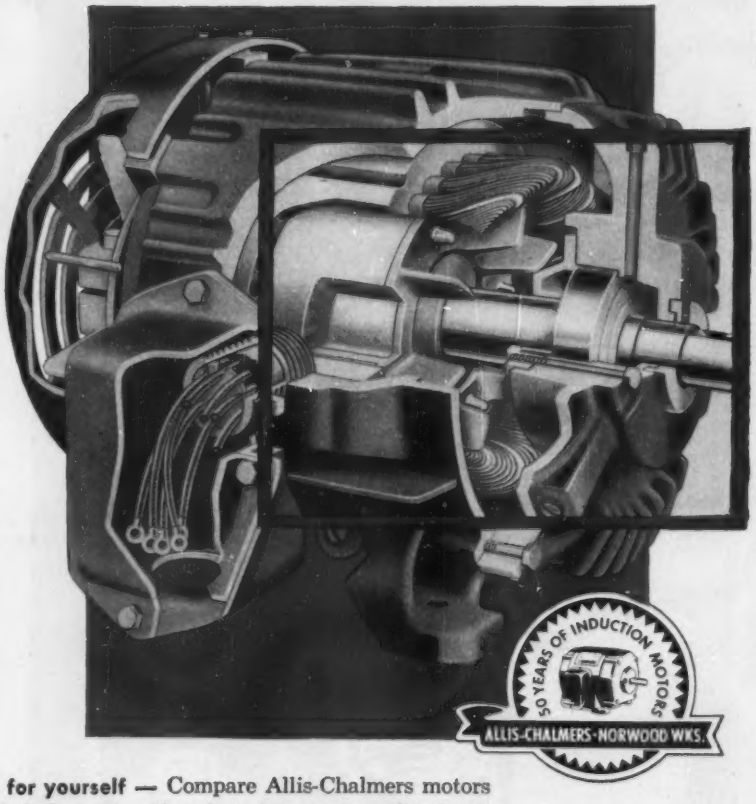


It takes 6 bolts not just 4 to give full bearing protection

THE TWO EXTRA BOLTS in the end housing of every Allis-Chalmers ball bearing motor are the proof of *extra* protection against bearing failure. These are the bolts that hold the bearing cap tightly in place against the inner face of the bearing enclosure. This cap, with its close running clearances, keeps grease from the interior of the motor . . . retains an ample supply within the bearing enclosure . . . protects the grease and the bearing against contamination from dirt and moisture.

At the outer side of the bearing, double labyrinth seals keep grease in, also keep dirt out. What's more, large grease reservoirs act as additional dirt traps.

Result? Allis-Chalmers motors pay off in longer, trouble-free bearing life, lower motor maintenance.



Get all the facts . . . judge for yourself — Compare Allis-Chalmers motors with other motors. Get the six-bolt construction that gives you complete bearing protection. For proof, see your Allis-Chalmers Office or Authorized Distributor, or write — Allis-Chalmers, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

A-4441

Diamonds are a tool's best friend

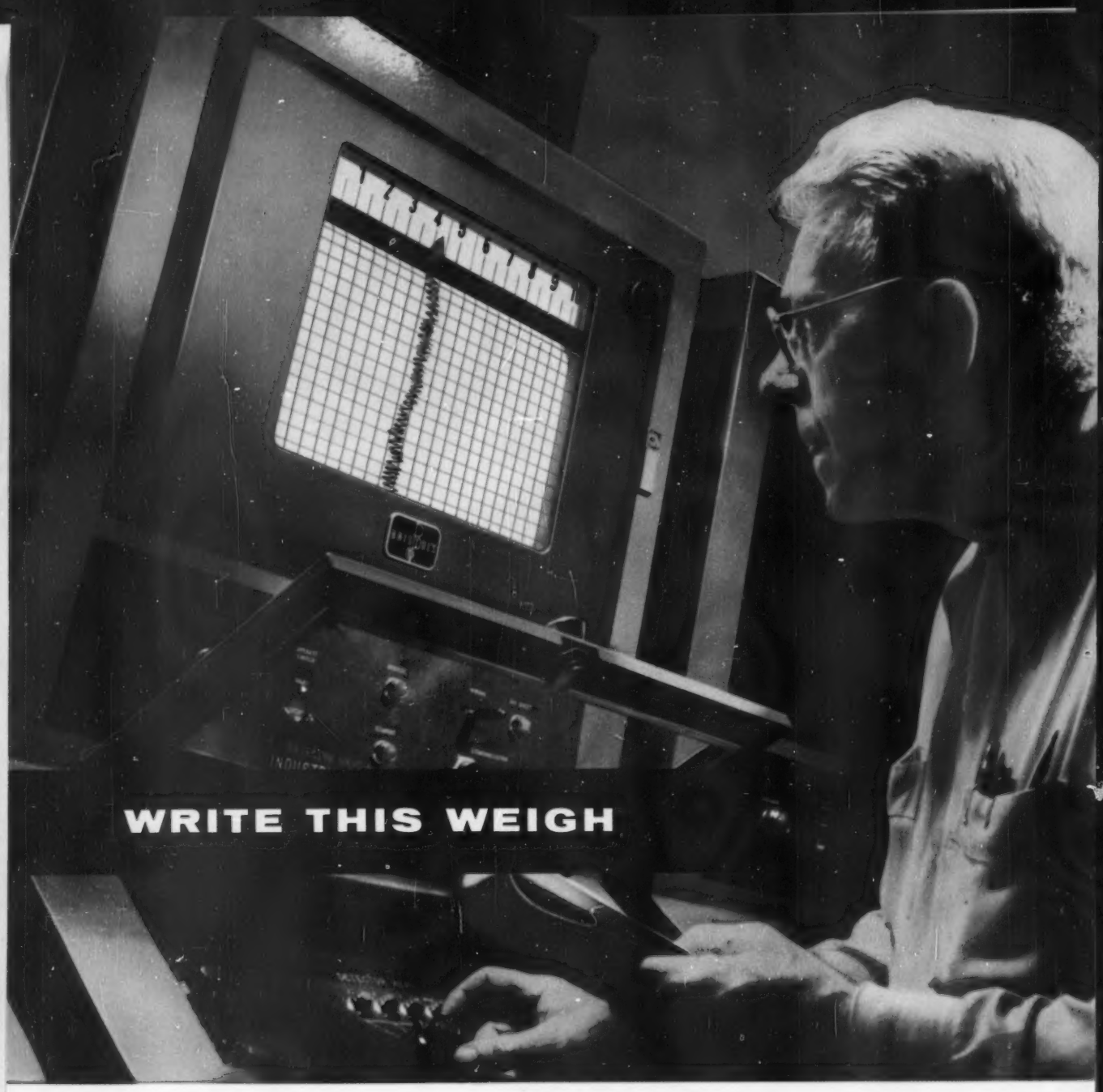
Hard cemented carbide cutting tools demand keen edges, extra-fine finishes, close tolerances...and you'll get all this with Diamond Wheels by CARBORUNDUM. They cut cool—increase tool life...hold size and profile—give the sharpest edges—where sharpness is important... reduce grinding time—often eliminate intermediate operations... save you money—one wheel grinds thousands of tools. For roughing dull or broken tools...use GREEN-GRIT Silicon Carbide Wheels by CARBORUNDUM. For expert counsel, fast service for every tool grinding operation, call your CARBORUNDUM Distributor or Salesman.

Through product quality and application "know-how"

CARBORUNDUM

REGISTERED TRADE MARK

continually puts more sense in your abrasive dollar



This Beta-Ray Gauge supervises the scientific precision you get in all Coated Abrasive Products by CARBORUNDUM. With its piercing nuclear "eyes" it measures and records the weight, or thickness of the backing, bond and abrasive grain as they are combined on giant roll-making machines. The result: dependably uniform coated abrasive products, unvarying in quality from one order to the next . . . to give you consistently dependable performance on every sanding and finishing job. This is but one of many scientific quality checks made by CARBORUNDUM on all coated abrasive products, to give *you* fast, efficient economical sanding and finishing. Your CARBORUNDUM Distributor or Salesman is the man to call.

Through product quality and application "know-how"

CARBORUNDUM

REGISTERED TRADE MARK

continually puts more sense in your abrasive dollar

HAVE YOU LOOKED AT NEW LATHES LATELY?

New lathes may not be the whole answer to lower costs—but they will help!

You know how important it is to lower costs; and if you study the features of new lathes being offered today, you can learn how to make savings in toolroom and on production.

Rivett offers two lathes for one!

This observation is particularly true if you look at the new Rivett Model 1020S Precision Toolroom Lathe. It features sensitivity for turning tolerances within .0004″; and heavy biting ruggedness for a ¼″ cut at .020″ feed in cold rolled steel. In short, it is an instrument lathe and an engine lathe combined to handle any work within its 12½″ swing and 20″ centers.

26 Features Distinguish Rivett 1020S

The Rivett Model 1020S is head and shoulders above any ordinary lathe. Its design includes 26 individual qualities that substantiate Rivett's reputation for extreme precision and economical production.

Write for free catalog

Why not write for the new Rivett Catalog 1020B and read these important 26 features—compare them with the designs of other makes of lathes—and thereby realize what a Rivett can do for your shop in the way of time and money (not to mention how happy it will make any *real* machinist to work with such *real* precision!)

RIVETT

RIVETT LATHE & GRINDER, INC., DEPT. AMR 8, BRIGHTON 35, BOSTON, MASS.

This is another of the "HUNDREDS OF JOBS" which can be done on a MARVEL Band Saw!

MARVEL BAND SAW saved these two 3400 lb. castings

Two sand cores washed out when these giant 4400 pound steel connecting rods were cast, resulting in solid eye ends without gaps. Then came the $64 question—how to machine out the 1½" slots in the longitudinal center of the eyes which were 22" high and had a wall thickness of 6½".

The Ernest J. Nelson Iron Works of San Francisco, did this "impossible" job easily, quickly and economically, without special tooling, on a standard Model #8M/2 MARVEL Band Saw. Two cuts were made in each rod in two hours per cut with tool cost of $3.06 per rod. The tool was a MARVEL B9-10 Band Saw Blade.

Every tool room, machine shop and maintenance department needs a MARVEL Series 8 Universal Band Saw—not only for innumerable everyday jobs but for the occasional "trick" operations, where its utmost versatility will save many headaches and dollars.

WRITE FOR CATALOG

MARVEL Metal Cutting SAWS
Better Machines-Better Blades

These exclusive Marvel Features made this job easy.

1. Large, T-slotted work table.
2. Blade feeds into work vertically; work always stationary.
3. Power-Pressure feed.
4. Automatic Blade tension.
5. Built-in coolant system.
6. Large capacity.

ARMSTRONG-BLUM MFG. CO.

5700 BLOOMINGDALE AVENUE **CHICAGO 39, ILLINOIS**

SEND OUR CATALOG file

MILESTONES IN MEASURES

During the time of the Norman Conquest, ***a yard was fixed by law to be the distance between the King's nose and the end of his outstretched hand.*** This, however, was not very stable, as the standard changed with every reigning monarch.

Some 4000 years ago, when the Pyramids were being built on the Egyptian sands, there was a definite system of measurement — not as accurate as our present day methods, but nevertheless, they served their purpose. ***The standard, was the cubit the length of the human forearm.***

In the days of Edward II of England, ***the inch was decreed to be the length of three barley corns taken from the middle of the ear and placed end to end.*** No accounting was made for differences in sizes of the ear.

TODAY...

Use Size Control Co.'s *reversible* gages for greater economy and reliability!

THE FINEST GAGES MADE...

Fixed gages for measuring holes were solid cylindrical pieces. These solid pieces were inefficient by modern gaging standards because as soon as the go end was worn — the gage had to be thrown away.

Later, a taperlock gage was developed and this was a step in the right direction because go ends could be replaced when worn.

Size Control Company improved the taperlock design early in World War II when they originated the *reversible* thread plug gage with the following advantages: Member can be reversed when end is worn . . . worn ends can be cut off to expose several additional gaging surfaces . . . this increases gage life many times . . . members can be adjusted for length of hole.

Send for Size Control Catalog 53 to learn of many more economies and quality-building features.

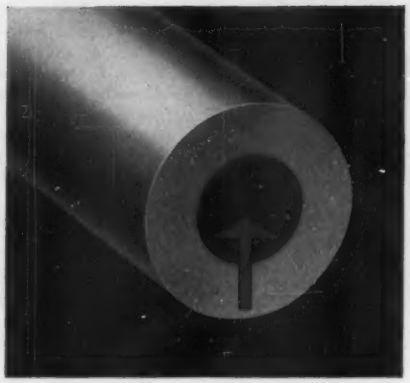
SIZE CONTROL COMPANY

2500 WEST WASHINGTON BOULEVARD
CHICAGO 12, ILLINOIS • MOnroe 6-6710

A Division of the AMERICAN GAGE & MACHINE COMPANY

PRECISION
Originators of
REVERSIBLE THREAD GAGES

a hole here is annoying . . .



a hole here is helpful

Crucible Hollow Tool Steel Bars are helping eliminate the wasteful practice of drilling out a solid bar to make ring-shaped, or tubular steel parts, or tools with a center hole. The hole is already in Crucible hollow tool steel bars . . . no need for drilling, boring, cutting-off or rough-facing operations.

You can get these hollow bars in any of Crucible's famous tool steel grades, in almost any combination of O.D. and I.D. sizes. And you can get *immediate* delivery of five popular grades—KETOS® oil-hardening, SANDERSON® water-hardening, AIRDI 150® high carbon-high chromium, AIRKOOL® air-hardening, and NU DIE V® work tool steels—from a conveniently located Crucible branch warehouse.

Call your Crucible representative for the full story of how these steels can best save you time and money. You'll be glad you did.

CRUCIBLE first name in special purpose steels

54 years of Fine steelmaking

HOLLOW TOOL STEEL

CRUCIBLE STEEL COMPANY OF AMERICA • TOOL STEEL SALES • SYRACUSE, N. Y.

THAT'S JUST THE POINT!

. . . . Yes, but a mighty important part of any Twist Drill. That's where the first contact comes, that's where hole size, roundness and surface smoothness are made or lost. That, in short, is the heart of the drilling operation.

GTD-AMPCO Drills are made with special attention to point accuracy, but behind the point you'll find that GTD-AMPCO Drills are exceptional for concentricity of flutes and lands, regularity of margins, polished flutes for better chip slippage, *and* in sizes over 1 inch the exclusive GTD-Ampco feature . . . they're HAMMER-FORGED for extra toughness and longer wear life.

AMPCO TWIST DRILL DIVISION

GREENFIELD TAP AND DIE CORPORATION

GREENFIELD, MASS.

ARMSTRONG

Use the Correct...

ARMSTRONG TOOL HOLDERS

to increase pieces, production and profits!

Because they do their work so well, without repairs, maintenance or replacement . . . because they last for years and have become as much a part of everyday operations as steel itself, the importance of using the correct type and size ARMSTRONG TOOL HOLDER for each operation, is frequently overlooked. It should always be remembered that by controlling the cutting point, ARMSTRONG TOOLS control both the productivity and efficiency of every lathe, planer, slotter, and shaper in most shops.

Tools so vitally situated, no matter how trouble-free, deserve periodic checking . . . checking to see that the correct size and correct type ARMSTRONG TOOL HOLDER is being used for each operation: checking to be sure that you are taking full advantage of the newer additions to the Armstrong System—the special types for ARMIDE (Carbide Tipped) Cutters, others for ARMOLOY (Cast Alloy) Bits and Blades; the newer "spring" form threading tools and cutting-off, etc., etc.

Write for a recent ARMSTRONG Catalog and check your tooling of each operation.

ARMSTRONG BROS. TOOL CO.

"THE TOOL HOLDER PEOPLE"

5215 W. ARMSTRONG AVE. **CHICAGO 30, ILL.**

Gas-Turbine-Powered Pump on Test at Navy Fire Fighting School

Where Hyatts turn at 40,000 rpm!

Old in theory, gas turbines are comparatively new as a practical power source. So it was big news in engine development when Solar Aircraft Company, of California, announced the world's first portable, hand-started gas turbine power plant.

Developing 50 horsepower, the new lightweight operates at the high speed of 40,000 rpm—or twenty times the speed of most automobile engines! And that's where *we* come in.

To be sure of complete bearing dependability for such high-speed operation, Solar turned to Hyatt . . . and there's a Hyatt Hy-Load Roller Bearing at the most critical position on the turbine shaft.

Whether you're building locomotives or lawn mowers, and whether shafts turn at 4 or 40,000 rpm, you'll get better bearing performance from *Hyatts!*

HYATT

STRAIGHT ROLLER BARREL ROLLER TAPER ROLLER

HYATT BEARINGS DIVISION • GENERAL MOTORS CORPORATION • HARRISON, NEW JERSEY

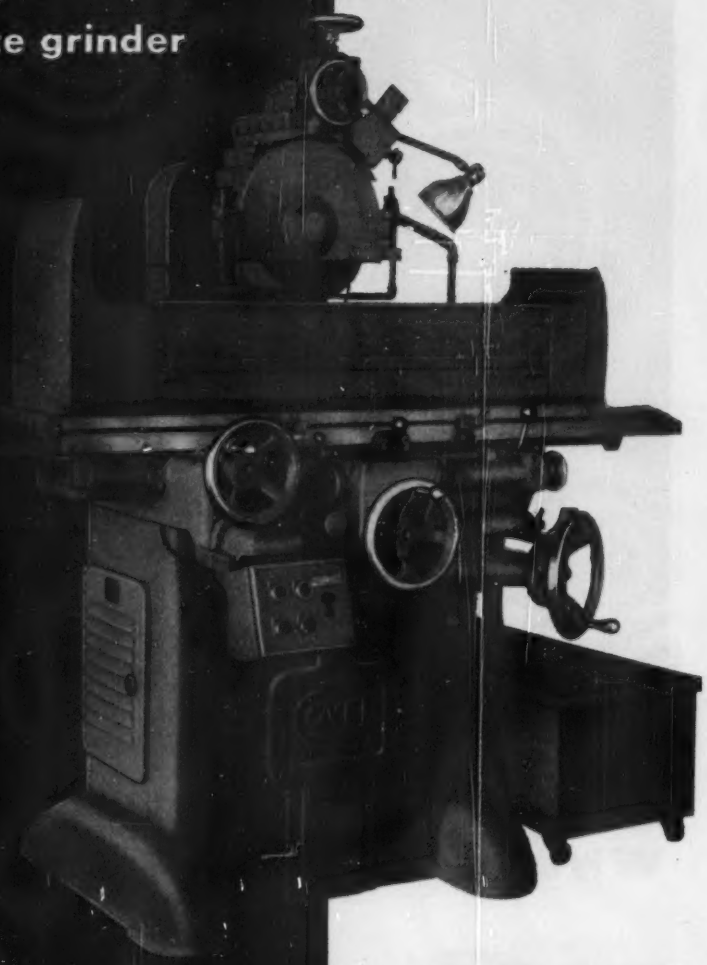
ROLLER BEARINGS

WHAT COVEL'S 80 YEARS CAN MEAN TO *you*

when you select a surface grinder

It takes more than special features and fine materials to build the best surface grinders. Skilled workmanship, yes . . . modern methods and equipment, certainly. But there's a rare quality—a plus value that can make your grinder investment extra sound and that quality is yours with Covel . . . It's simply this: EIGHTY YEARS OF CUMULATIVE EXPERIENCE—of constant progress, keeping pace through four war production periods and through many business peaks and valleys.

So, when you select a Surface Grinder —or a Cutter and Tool Grinder, call on Covel and draw on this wealth of practical, productive experience. Send for data.



SURFACE GRINDERS
HYDRAULIC FEED:
14"x24"; 8"x24"; 6"x18"
HAND FEED: 6" x 18"
Send for Bulletin AM-184

UNIVERSAL
CUTTER and TOOL GRINDERS
10"x30"; 10"x24"; 8"x16"

COVEL PRECISION GRINDERS

BENTON HARBOR, MICHIGAN

DRILL GRINDERS • UNIVERSAL CUTTER & TOOL GRINDERS • HYDRAULIC & HAND FEED SURFACE GRINDERS

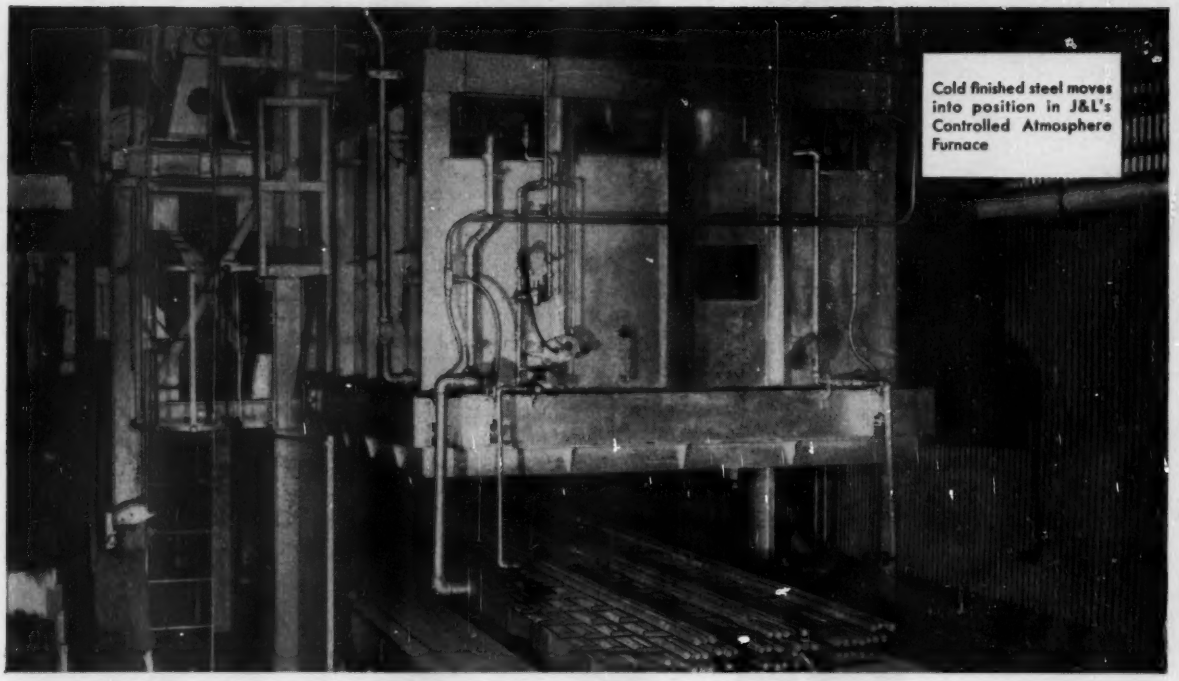
Cut Your Production Costs

whatever treatment you need:

- bright annealing
- case carburizing
- normalizing
- stress relieving
- carbon restoration

thermal treatment in prepared atmosphere furnace

saves you time
lowers over-all costs



Cold finished steel moves into position in J&L's Controlled Atmosphere Furnace

Why incur the trouble and costs of thermal treatments when J&L can do the job for you . . . quickly and economically? J&L's Controlled Atmosphere Furnace can be employed to improve the machinability or to meet the mechanical properties you need in your bar stock.

Order J&L Cold Finished Bars—thermally treated to the needs of your production line.

Jones & Laughlin
STEEL CORPORATION – *Pittsburgh*

J&L STEEL

Jones & Laughlin Steel Corp., Dept. 402
3 Gateway Center, Pittsburgh 30, Pa.

Without obligation please send me your booklet "Extra Services to Users of Cold Finished Steel."

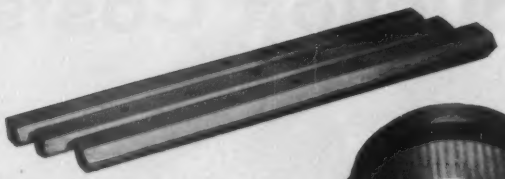
Name_____

Title_____

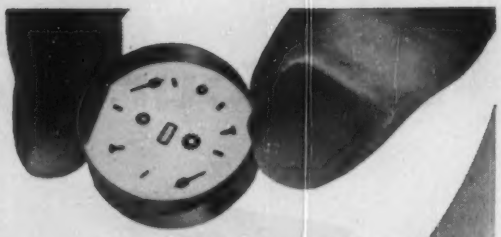
Company_____

Address_____

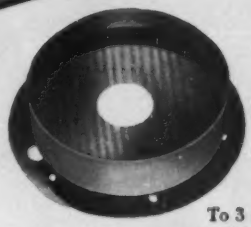
_____



Hardened steel machine tool ways, 2½" x 3½" x 50", ground on 6 sides, flat within .001" with surface finish of 5 micro-inches—*5 times faster than other methods!*

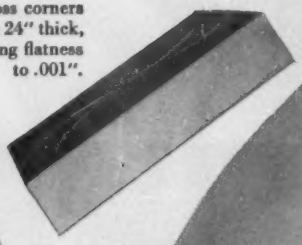


Tiny watch gears, pinions and ruby bearings—flat and parallel—to a dimension tolerance of .0002".

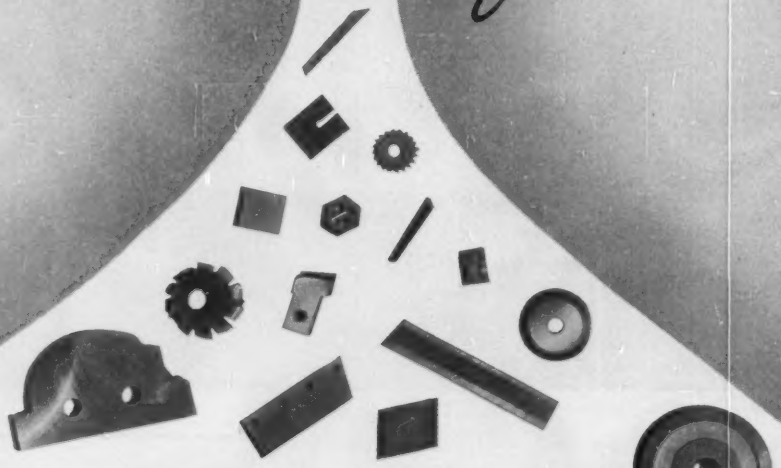


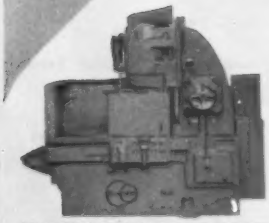
To 3 micro-inches and flat within *one* light band.

Die plates, 84" across corners and perhaps 24" thick, holding flatness to .001".



"Specs" like these call for Blanchard





NO. 18 BLANCHARD SURFACE GRINDER

Every day, parts like these are ground accurately and rapidly on Blanchard Surface Grinders equipped with Blanchard Abrasive Wheels. They're ground economically too—at costs which help you set competitive prices.

Send a sample of your parts for free test grinding and recommendations.

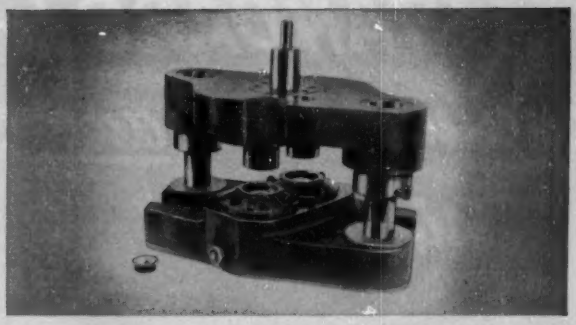
Send for your free copies of "Work Done on the Blanchard", fourth edition, and "The Art of Blanchard Surface Grinding".

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY

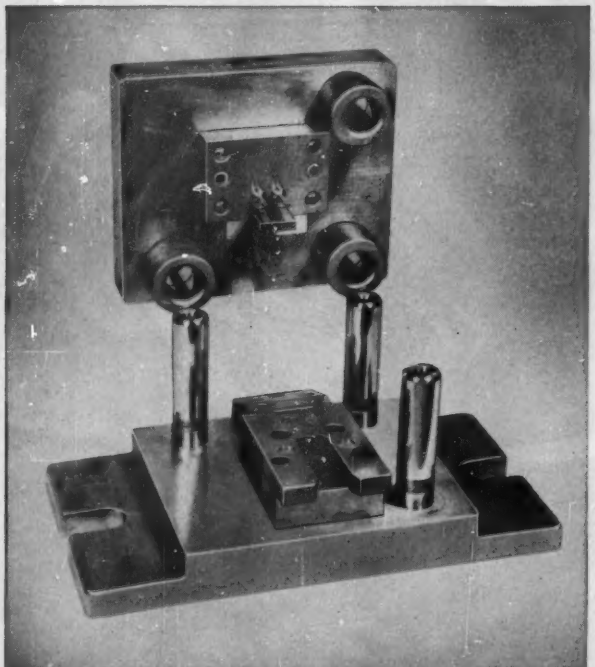
64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.

1 Lamination die, made for Schick, Inc., produces rotor and stator laminations of motor-grade silicon steel. Customer reports carbide die produces average runs 35 times as long as steel dies.



2 Blanking and drawing of screw bottle caps is done by this die for Armstrong Cork Company, Lancaster, Pa. Die operated accurately on material .006" thick for months. Steel die had to be changed each week.

Case histories show how dies reduce costs when equipped with Carboloy® cemented carbide



3 Simple pierce and cutoff die, designed for Electric Auto-Lite Co., Toledo, operates at speeds faster than 400 strokes per minute. Die has produced over 2,000,000 strokes . . . and still does not require sharpening.

Actual plant performance has proved how easy and profitable it is to use Carboloy cemented carbide over a wide range of applications. For blanking, forming, drawing and piercing . . . for large or small, simple or complex dies . . . only carbides will give you benefits like these:

- **Production runs 35 times greater than steel (see picture No. 1)**
- **Accurate tolerances held for months . . . as compared to days with steel (see picture No. 2)**
- **Over two million high-speed strokes . . . without needing resharpening (see picture No. 3)**

If you wish, a member of the Carboloy Engineering Appraisal Service will call at your plant, without obligation. He'll show you how simple it is to wear-proof your dies; how to get increased production with fewer rejects. And you can send your key personnel to the Carboloy Die School in Detroit.

Also free is the Carboloy Die Engineering Manual D-124. It shows you how easy it is to design, apply and maintain carbide dies. For any of these free, cost-reducing Carboloy services or literature, send coupon below.

FILL OUT THIS COUPON—MAIL IT TODAY!

CARBOLOY Department of General Electric Company
11149 E. 8 Mile St., Detroit 32, Michigan

- ☐ Rush me free Carboloy Die Engineering Manual D-124.
- ☐ Send complete details on free Carboloy Die Training School.
- ☐ Have a representative of the Carboloy Engineering Appraisal Service call at my plant, at no obligation to me.

Name_____ Title_____

Company_____

Address_____

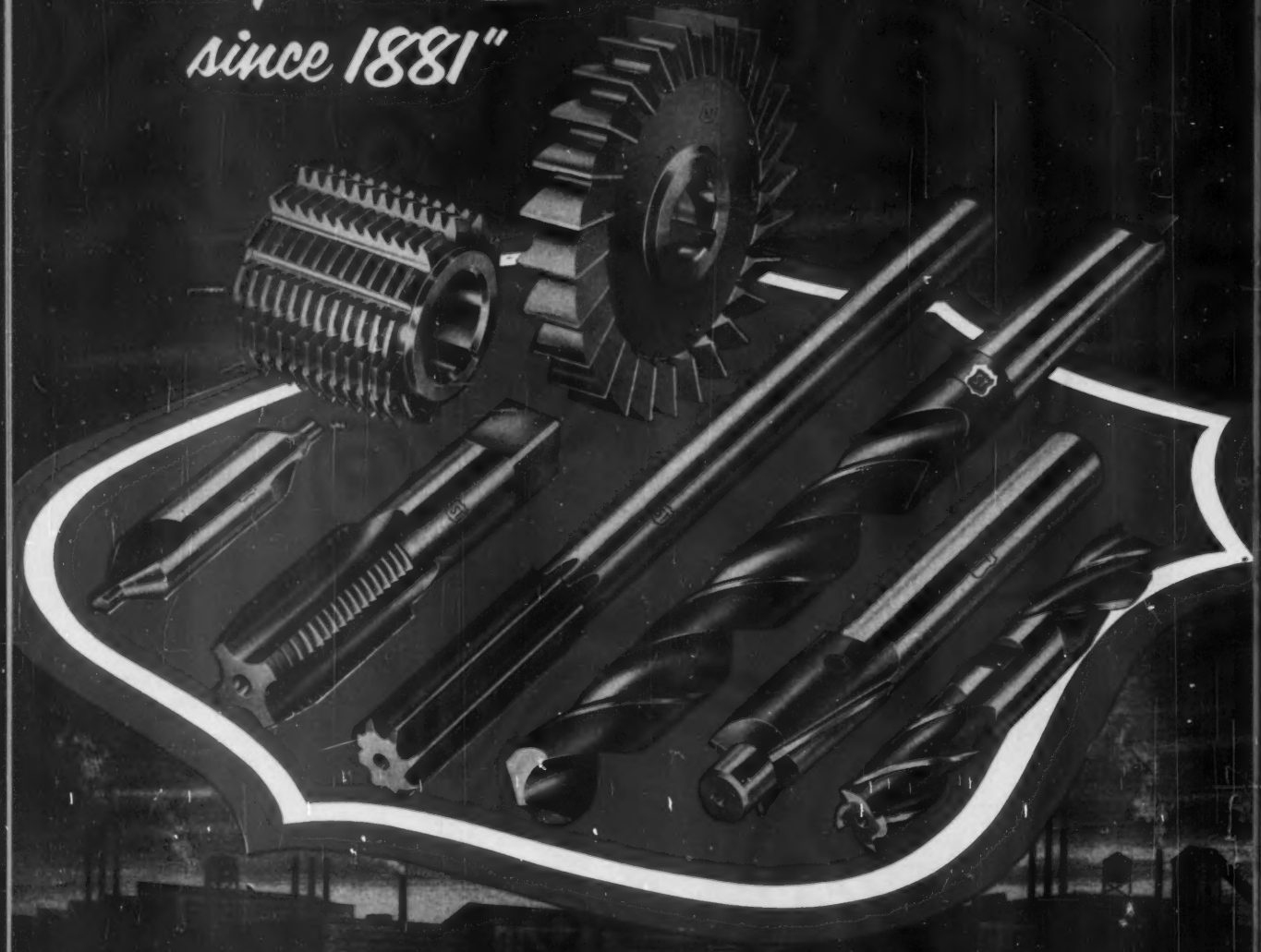
City_____ Zone_____

State_____

CARBOLOY
DEPARTMENT OF GENERAL ELECTRIC COMPANY

"Carboloy" is the trademark for products of the Carboloy Department of General Electric Company

"STANDARD for cutting metal and costs since 1881"



Red Shield says:

Cut machining costs . . . standardize with Standard. Complete line . . . top quality tools. Backed by factory application specialists coast to coast. Distributors in all principal cities.

STANDARD TOOL CO.

3950 CHESTER AVENUE . CLEVELAND 14, OHIO

FACTORY BRANCHES IN: NEW YORK • DETROIT • CHICAGO • DALLAS • SAN FRANCISCO

THE STANDARD LINE: *Twist Drills · Reamers · Taps · Dies · Milling Cutters · End Mills · Hobs · Counterbores · Special Tools*

A NEW APPROACH TO PRECISION BORING

HIGHER PRODUCTION RATES—This Bryant Boring Machine produces uniform fine finishes—at peak production rates. It assures highest repetitive accuracy in precision boring, drilling, turning, facing, grooving and contour boring and turning.

The table is actuated by a simple cam and lever unit **A** which provides positive control of the cycle at all times. This mechanical actuation eliminates variation in the cycle due to temperature change.

FINER FINISHES—The Bryant 998 provides the smooth, uniform table motion so essential in generating a fine finish with a single point tool. The table moves on two 4" diameter solid steel slide bars **B** firmly bolted to the bed. The table is supported by two anti-friction preloaded ball bearings on each of these bars. This construction provides a metal-to-metal contact which eliminates shifting due to an oil film **C**.

MINIMUM DOWN-TIME—The Bryant 998 requires minimum servicing—motors, boring heads and slides are permanently grease sealed. Every unit is easily accessible.

SPECIFICATIONS—Total table stroke: 6"; Top of table to top of bridge: 4"; Width of bridge: 27⅜"; Multiple boring heads as required by tooling to a maximum of 4 (209) heads; Boring head motor: 5HP; Table dimensions: 17½" x 22"; Floor space (without coolant tank): 31" x 54".

20 REASONS WHY...

- Bed, bridge, table and heads are normalized Meehanite castings.
- Cam actuated table moves on preloaded ball slide bars.
- Cam is hardened and ground.
- Boring head spindles rotate in preloaded ball bearings.
- Air cylinder opposes the work table motion directly with constant pressure and keeps the cam follower roll and the cam always in contact.
- Boring head drive is completely accessible.
- Cam drive assembly is protected by a torque limiting clutch.
- Cycle time is controlled by precision change gears in the cam drive gear box.
- Pad is provided at the rear for mounting accessory equipment.
- Push button controls are conveniently located.
- Manual, semi-automatic or fully automatic cycle.
- Emergency stop button instantaneously interrupts the cycle.
- Jog buttons on both front and rear of the machine for setup purposes.
- Machined setup pads are provided on the bridge for ease in locating fixtures.
- Maintenance is necessary at only three points: two grease fittings on the cam follower assembly and cleaning and filling of the filter-lubricator unit in the pneumatic system.
- Ball slide table is grease sealed.
- Gear box has its own closed lubrication system.
- Boring head bearings are permanently grease sealed.
- Cam is easily accessible for changing the table stroke.
- Change gears are enclosed in their own wet sump, splash lubrication system.

Write today for complete details!

BRYANT Chucking Grinder Co.
SPRINGFIELD, VERMONT, U. S. A.

Internal Grinders • Boring Machines
Internal & External Thread Gages • Granite Surface Plates

The Results You Need in hole-accuracy and long life

are realized from

BALANCED *Action*

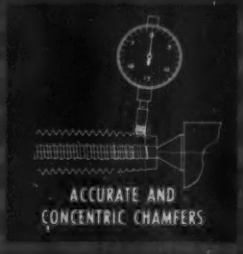
Taps by Winter

Here are the four principles of Winter Tap design and manufacture that result in Balanced Action:

EXACT FLUTE SPACING

UNIFORM FLUTE CONTOURS

PRECISION CHIP DRIVER CONTOURS



ACCURATE AND CONCENTRIC CHAMFERS

WINTER

WINTER BROTHERS COMPANY

Rochester, Michigan, U.S.A. Distributors in principal cities

Division of National Twist Drill & Tool Co.

ALWAYS AT YOUR SERVICE

Your local Industrial Supply Distributor carries a complete stock of WINTER Taps.

END MILLS
can do work not possible with any other tools

—and National offers you End Mills for almost any need, *available from stock.* All have the famous National cutting edges. They'll give you smooth operation and long life.

NATIONAL TWIST DRILL AND TOOL COMPANY

Rochester, Michigan, U.S.A.

Distributors in principal cities. Factory Branches: New York • Detroit • Chicago • Dallas • San Francisco.

Call Your Industrial Supply Distributor

for all your Supply requirements including NATIONAL Twist Drills, Reamers, Counterbores, Milling Cutters, End Mills, Hobs, and Special Tools.

NATIONAL TWIST DRILL & TOOL ROCHESTER, MICH., U.S.A.

National

OHIO FORGE AND MACHINE

OHIO F&M CO

eliminates two grinding operations

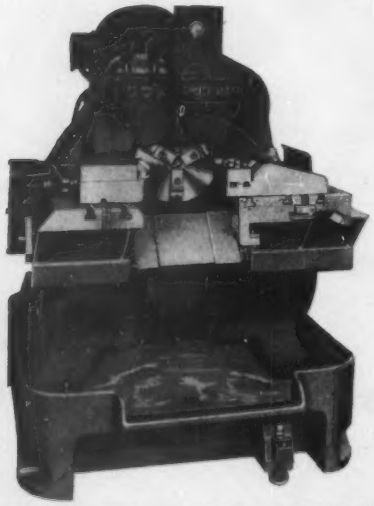
machining high precision diesel engine gear blanks

Machined on **CHUCK-MATIC** from A-4340 steel forging annealed.

1st operation: (on front side) Face hub and flange, form radius on O.D; bore and chamfer hole, turn O.D. partway.

2nd operation: (on other side) Face, finish bore and turn O.D. remainder.

ON ACME-GRIDLEY CHUCK-MATICS



Acme-Gridley 12" Single Spindle CHUCK-MATIC is radically different from any other machine heretofore offered for short length primary operations such as forming, turning, drilling, straight or taper boring, facing, etc.

By switching these jobs to Chuck-Matics, Ohio Forge and Machine Corporation in Cleveland, Ohio, now machine tough forged blanks concentric within .0002"—hold tolerances which eliminate the green (or soft) grinds previously required on bore and O.D. before the teeth could be cut.

And they save, too, with automatic control of cycle time—a predetermined machining rate that you can count on for every piece.

This Radically Different Chucker

is built for high speed precision work on heavy duty jobs. Check these features against your present methods—

- **automatic control of machine time cycle**
- **easy to set up and retool**
- **does not require skilled labor—one man operates as many machines as cycle times of jobs permit**
- **is space saving—only 45" wide, 64" long**
- **precision work at speeds and feeds as fast as carbide tools can take it.**

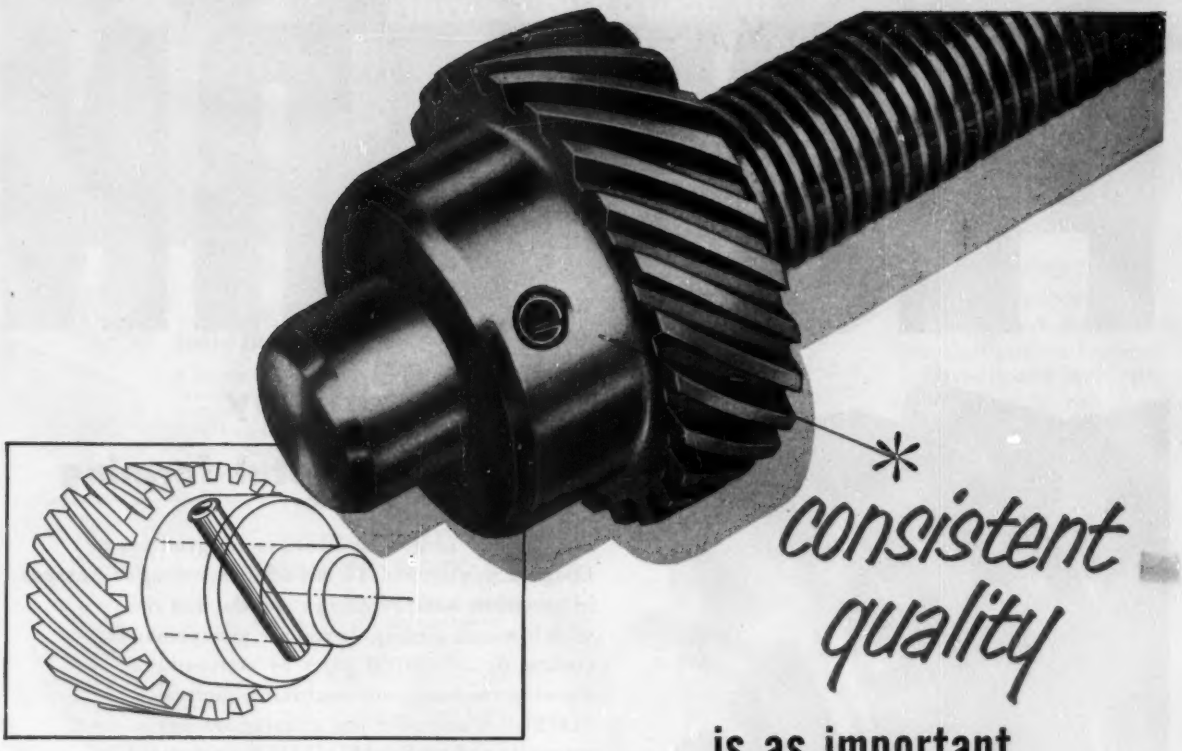
—then write for catalog SC-46. Or, better still, ask us to talk it over.

Nothing so completely destroys profits as the continued use of obsolete equipment

The NATIONAL ACME COMPANY

170 EAST 131st STREET • CLEVELAND 8, OHIO

ACME-GRIDLEY BAR and CHUCKING AUTOMATICS
1-4-6 and 8 Spindle • Hydraulic Thread Rolling Machines • Automatic Threading Dies and Taps • Limit, Motor Starter and Control Station Switches • Solenoids • Contract Manufacturing



consistent quality

is as important in the pin as in the gear

To function effectively, a spring pin must drive easily into holes drilled to normal production tolerances, compressing as driven. To drive easily, hold firmly and fit flush, the pin —*every* pin—must meet the strict requirements of specifications such as those prepared by the SAE and the Military Services.

Since failure of a pin can be as costly as a failure of any other precision part, it is important to check the pins *you* buy for uniformity . . . uniformity of diameter and length, shear strength, hardness, insertion and removal forces, and recovery of diameter.

Rollpin has been tested many times—by many manufacturers—with a consistently high performance record. It has been widely recognized as the "quality" fastener of its type. In this case, quality can be—and should be—measured. We strongly urge that you test for quality when buying spring pins.

ELASTIC STOP NUT CORPORATION OF AMERICA

Dept. R28-89 **Elastic Stop Nut Corporation of America**
2330 Vauxhall Road, Union, New Jersey

Please send the following free fastening information:

- ☐ Rollpin samples
- ☐ Rollpin bulletin
- ☐ Here is a drawing of our product. What self-locking fastener would you suggest?

Name_____ Title_____

Firm_____

Street_____

City_____ Zone____ State_____

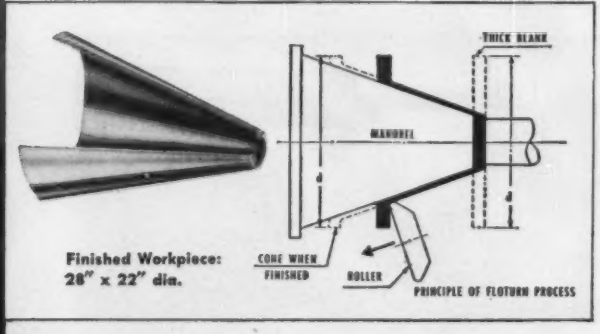
FLOTURN

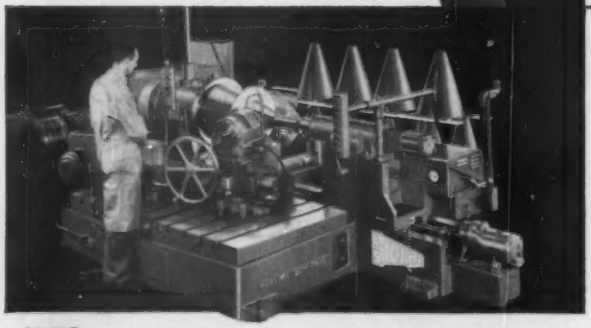
a new Lodge & Shipley development in metal forming

Axially rolls simple blanks into complex forms Displaces metal by cold flowing

FLOTURN is a new process originated by Lodge & Shipley. FLOTURN offers startling advantages in precision metal forming at production rates with low-cost tooling. If you are now producing conical or cylindrical parts by conventional drawing, welding, or machining methods FLOTURN may offer you amazing savings in time, materials and tooling! FLOTURN equipment or sub-contract service is available only through Lodge & Shipley and its distributors. Write for

Write for complete details.





No. 40 Lodge & Shipley Floturn Lathe for cold forming.

HOW FLOTURN WORKS

. . . the FLOTURN process starts with either a simple flat blank, machined blank, machined forging, drawn cup, wrapped and welded cylinder or centrifugal casting. FLOTURN equipment scientifically applies great pressure against the blank, causes the metal to flow in a cold state. Pressure is spirally applied continuously, flowing the metal to the shape of a mandrel.

FLOTURN IS HIGHLY ACCURATE

. . . wall sections of work are uniform, predetermined, with never changing thickness and can be easily held to ± .002".

FLOTURN SAVES TIME, MATERIALS, TOOLING

The FLOTURN blank weighs the same or slightly more than the finished part. FLOTURN tooling is low in cost—only about 1/10 the cost of deep draw dies, for example. Tooling life is long. FLOTURN forms a wide range of metals—from mild steel to the toughest alloys. FLOTURN adds strength and hardness.

L-S FLOTURN

THE LODGE & SHIPLEY COMPANY
3055 Colerain Avenue, Cincinnati 25, Ohio

Here's your guide to NEW SAVINGS with NEW Standardized BOSTON Gear Products — from STOCK

NEW

Certified
BEAR-N-BRONZ Solid Bronze Bearings

A complete line — 768 stock sizes of Standard Bearings — 221 stock sizes of Cored Bars — 35 stock sizes of Solid Bars. CERTIFIED Highest Quality, with a MONEY-BACK offer.

NEW

SPROCKETS Larger, heavy duty SHOLD-A-GRIP Interchangeable Tapered Sprockets and Bushings

Sprockets up to 24" pitch dia. — and Bushings to fit shaft sizes from ½" to 3" by 16ths. Also, more sizes available in conventional sprockets.

NEW

BOST-BRONZ BEARING BANK

A sturdy metal kit, with 47 common sizes of Bost-Bronz oil-impregnated bearings, from which 313 standard sizes can be cut with a hacksaw — means you have any bearing you need *on hand* in any emergency. Saves 50% over buying same bearings separately.

20 SHAFT SIZES UP TO 2 3/16"

NEW

PILLOW BLOCKS and Flanged Cartridges in larger sizes

ADDED TO FORMER ½" TO 1¼" RANGE

Now, precision Type ABEC No. 1 Classification Bearings in a stock size range for 27 shaft sizes from ½" to 2 3/16", fully self-aligning.

NEW

20° PRESSURE ANGLE SPUR GEARS in a full range of stock sizes

Off-the-shelf delivery on 20 pitch to 4 pitch with pitch diameters from .6" to 40". Save 20% in weight — space — cost.

NEW PRODUCTS Catalog NP-55

lists full specifications of these new Boston Gear products and many others in 196 pages. Get your copy . . . use it with your BOSTON Gear General Catalog No. 55 . . . for up-to-the-minute information on the products that make BOSTON Gear first choice of cost-wise buyers.

NEW

3-PIECE JAW COUPLING with BOST-BRONZ insert

BOST-BRONZ oil-impregnated Bearing cushions torsional load, resists wear from any rubbing friction . . . 17 stock sizes, with hole diameters from 3/16" to 1½".

Get your copy from your nearby

BOSTON Gear®

DISTRIBUTOR

Look under "Gears" in the Yellow Classified Section of your Telephone Directory for the BOSTON Gear Distributor nearest you. Catalog NP-55 also available from Boston Gear Works, 60 Hayward St., Quincy 71, Mass.

WANT A NEW LEASE ON PROFITS?

KEMPSMITH HAS ANSWERS FOR THAT '54 DOLLAR-QUESTION!

To meet the stiffer competition in 1954 you cannot afford to burden your milling machines by paying extra overhead charges to absentee owners. When you own your Kempsmith milling machines, you pay yourself the full dividends on your investment. Outright ownership of a modern Kempsmith milling machine will help you hold your profit-line and remain competitive. By BUYING Kempsmith milling machines you can eliminate "double-charges" on your job costs.

You can buy KEMPSMITHS at reasonable cost . . . because they are designed to avoid costly non-essentials. Their practical performance advantages keep costs low for operation and maintenance. Get KEMPSMITH Millers and you get a new lease on profits.

• *You'll find* interesting data in Bulletin No. 134 on the new

IMPROVED TYPE "G" KEMPSMITH MILLING MACHINES

Write for this Bulletin Now!

THERE'S A KEMPSMITH DISTRIBUTOR NEAR YOU...
Contact him
or write to

KEMPSMITH MACHINE CO., MILWAUKEE 14, WISCONSIN, U. S. A.

KEMPSMITH

PRECISION-BUILT MILLING MACHINES FOR 1954 PERFORMANCE

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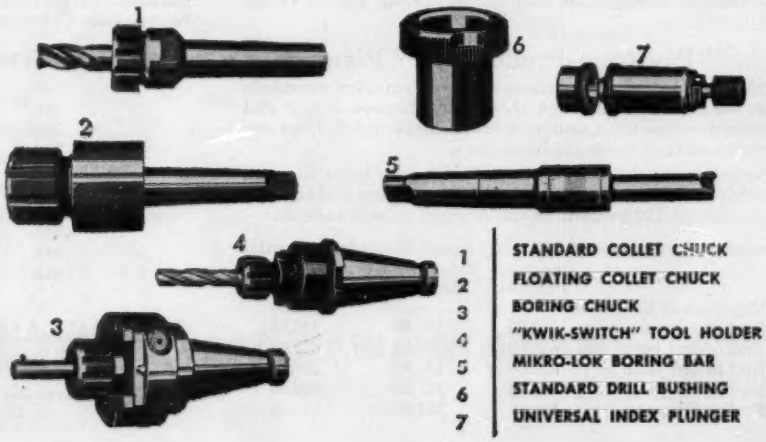
UNIVERSAL
DRILL BUSHINGS OUTLAST THEM ALL!

Several factors contribute to the long life of Universal Drill Bushings. They are machined from an unusually high quality steel. Their superfinish bores reduce wear. The blended radius on the top inside diameter helps prevent tool hang-up and breakage. 100% concentricity and hardness tests help guarantee their accuracy and uniform quality. Knurled heads provide a quick, sure grip. Available in a complete range of standard sizes and lengths. Orders for special dimensions will receive prompt attention. For complete information, write to the office nearest you — Universal Engineering Sales Co., 1060 Broad St., Newark 2, N. J.; 5035 Sixth Ave., Kenosha, Wis. — or our home office.

180

UNIVERSAL ENGINEERING COMPANY
FRANKENMUTH 1, MICHIGAN



1 STANDARD COLLET CHUCK
2 FLOATING COLLET CHUCK
3 BORING CHUCK
4 "KWIK-SWITCH" TOOL HOLDER
5 MIKRO-LOK BORING BAR
6 STANDARD DRILL BUSHING
7 UNIVERSAL INDEX PLUNGER

THE LONG VIEW

on the buying and leasing of industrial equipment

JONES & LAMSON'S 3-WAY MARKETING SERVICE

To further facilitate the expansion of American productivity and markets, Jones & Lamson now offers *three* plans for the procurement of machine tools.

They are designed to accommodate the widest possible variety of industrial needs, and to establish top industry standards for sound practice.

Outright Purchase

The outright purchase of capital equipment is generally preferred. It offers the obvious advantages to the user of lower cost, freedom of operation, and full profit from the use of the equipment.

"Pay-from-Productivity" Plan

Plans are also offered for those who prefer making payments from the additional savings created by the use of new and modern machine tools, and on terms more favorable than can be obtained from most credit sources.

Payments may be made on a one to five year basis, in equal monthly installments, with a small down payment and a charge at the rate of 3.25 percent on the original unpaid balance.

(Payment Analysis per $1,000. Sixty Equal Monthly Payments)

	Remaining Principal	Total Payment During Year	Total Cumulative Payments
Payment at Shipment	—	—	250.00
End of 1st year	600.00	190.89	440.89
End of 2nd year	450.00	181.89	622.78
End of 3rd year	300.00	172.89	795.67
End of 4th year	150.00	163.89	959.56
End of 5th year	None	154.89	1,114.45

The Lease Plan

Leasing may be advantageous when working capital is inadequate for necessary plant modernization or expansion, and when alternative uses of capital are more pressing or more profitable.

Under the Jones & Lamson plan, the customer gets the normal 1 year guarantee, and he may offer to buy the machine at the end of any year, at the then existing fair market value or at a predetermined option price.

To provide maximum flexibility, the plan is available in four variations, the principal differences being in the annual rental and return charges. With each plan, a 10 percent deposit is required, to be refunded to customers upon fulfillment of transaction. The minimum payment plan is shown below.

(Annual Rental per $1,000 Selling Price)

Year	Rent	Return Charge
1st	$180	$500
2nd	180	360
3rd	180	240
4th	180	120
5th	180	None
6th	180	None
7th	60	None
8th	60	None
9th	60	None

JONES & LAMSON MACHINE COMPANY

502 Clinton St., Springfield, Vermont, U.S.A.

Turret Lathes — Fay Lathes — Thread & Form Grinders — Optical Comparators — Threading Dies

WICKES Smalley General Thread Millers

at FORD MOTOR COMPANY

WICKES Smalley General Thread Millers have long been known for their efficient operation. Finish and accuracy obtained eliminate grinding. Efficient on internal or external threads. Note this typical case —

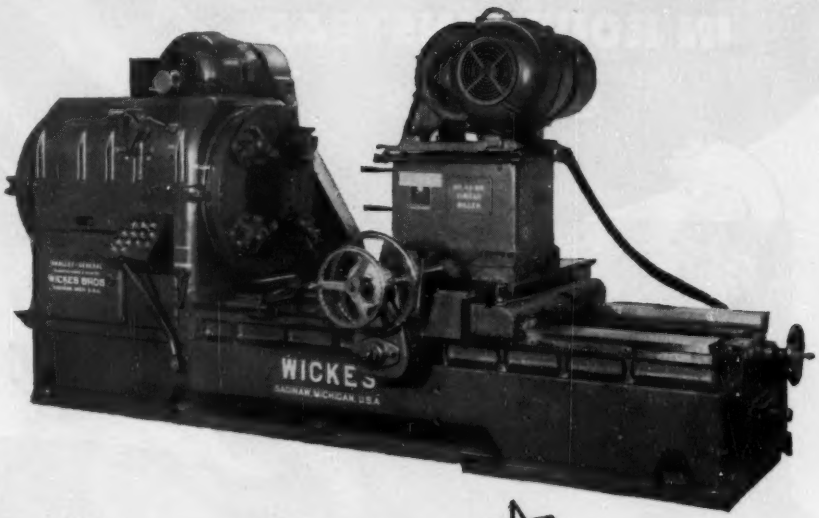
Part: Jet Engine Turbine Shaft
Metal: AMS 6415 Steel heat treated to Rockwell C-35-40

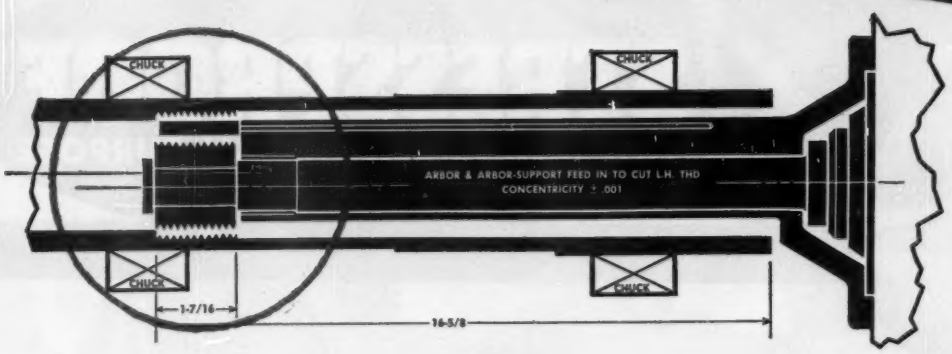
Milling internal thread:
Size 5.3125 — 16 NLH —
P. D. 5.2719 — 5.2785

Thread milling cutter speed:
70 F.P.M.

Work feed: 5 inches per minute

Milling cycle: 5.9 minutes @ 100%





Available WICKES Smalley General Machines:

Size:	#18	#30	#44
Weight:	14,000 lbs.	23,000 lbs.	29,000 lbs.
Capacity:	8¼" hole thru spindle	17" hole thru spindle	18½" hole thru spindle

Send for latest bulletin on any of these machines.

100 YEARS' EXPERIENCE IN SOLVING PRODUCTION PROBLEMS

WICKES BROTHERS · SAGINAW, MICHIGAN

DIVISION OF THE WICKES CORPORATION

83

Make Your Own Repair Parts

IN HOURS INSTEAD OF DAYS

WITH

La Salle

STRESSPROOF®

THE HIGH-STRENGTH, ALL-PURPOSE STEEL BAR

You can *make your own* replacement shafts, spindles, screws, and other machinery repair parts *quickly* . . . right in your own plant from STRESSPROOF, the all-purpose steel bar.

With STRESSPROOF, you simply machine the part you need, then install it. That's all . . . no heat treating, no straightening, no carburizing! You're back in operation in hours, not days.

And there's no need to worry about *what* steel to use . . . the qualities you need are built-in. STRESSPROOF is *as strong as* heat-treated steels of equal hardness; *wears better* than many heat-treated carbon or alloy steels; and *machines easily* . . . 50% to 100% faster than carbon or alloy steels of equal hardness.

STRESSPROOF is stocked by leading steel warehouses from coast to coast.

Write for your free copy of this helpful new brochure, "Make Your Own Repair Parts."

La Salle STEEL CO.

1416—150th Street · Hammond, Indiana

Phone: Sheffield 6090

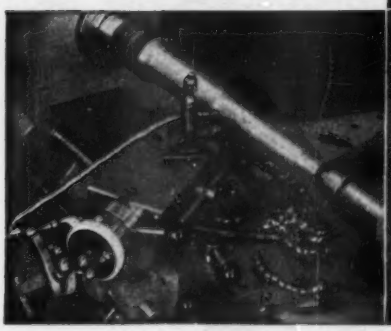
HARDINGE
ELMIRA, N.Y.

TOOL ROOM LATHE

Features QUICK *Feed Change*

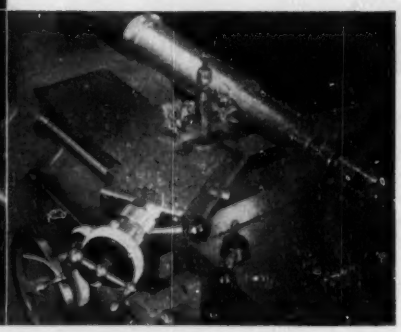
Simply TURN KNOB FOR EXACT FEED REQUIRED

CHANGE FEEDS WITHOUT STOPPING SPINDLE OR CHANGING OR SHIFTING GEARS



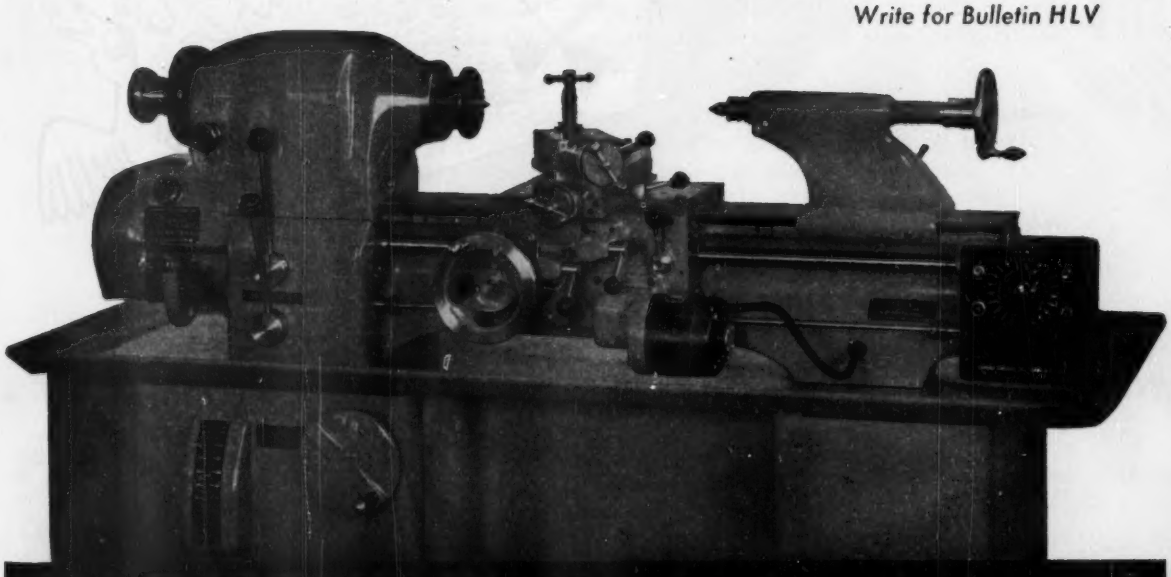
COARSE FEED

MEDIUM FEED



FINE FEED

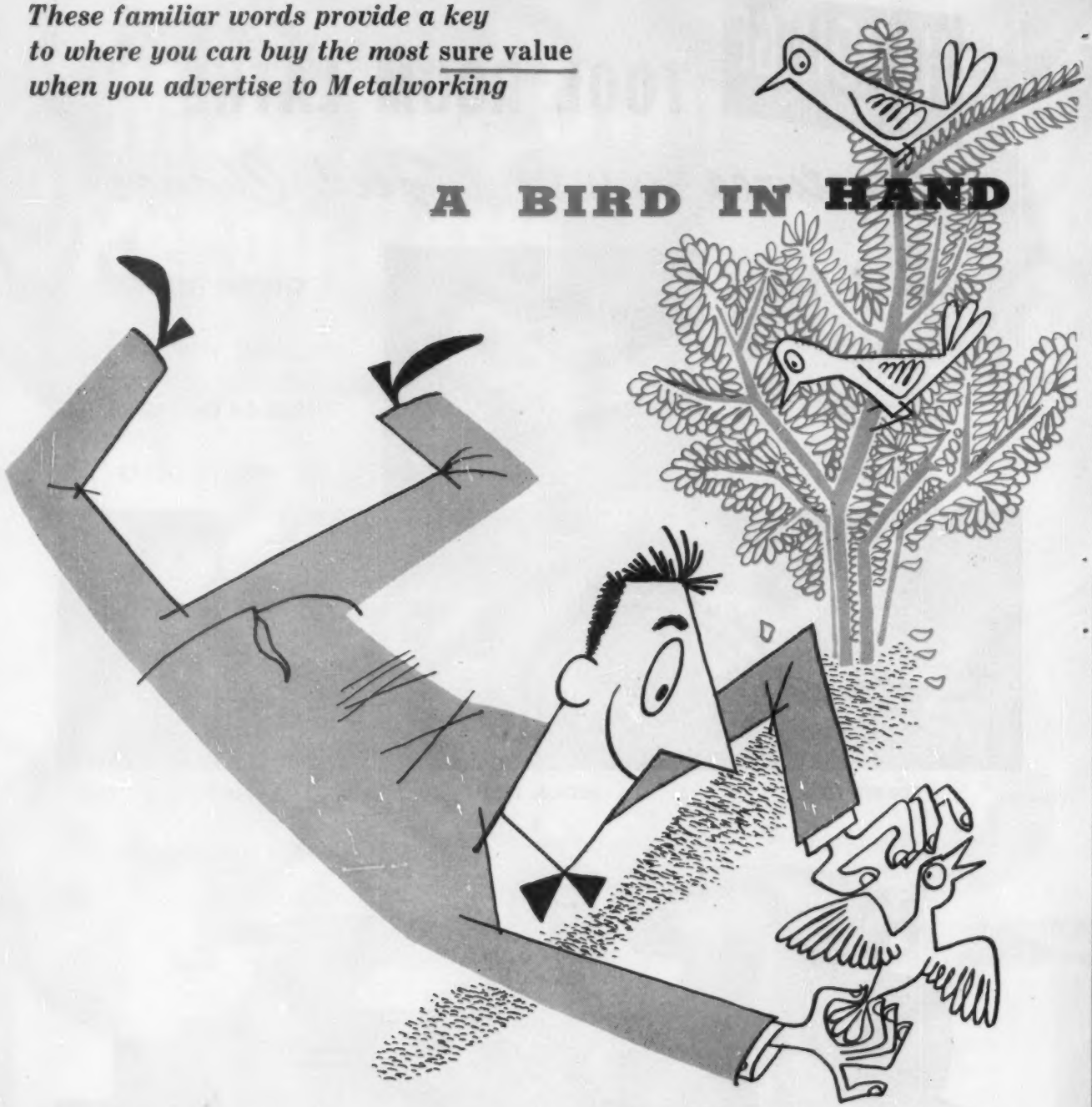
Write for Bulletin HLV



HARDINGE BROTHERS, INC., ELMIRA, N. Y.

These familiar words provide a key to where you can buy the most sure value *when you advertise to Metalworking*

A BIRD IN HAND



put the power of Metalworking's great sales builder.

ABP ABC

IS WORTH TWO IN A BUSH

In the vast reaches of Metalworking, millions of men are at work, and many thousands of them have a greater or lesser voice in the multi-billion-dollar purchases of this $95-billion industry.

What *you* care about most, however, are not the academic statistics of a great industry . . . but the *advertising-minded* ones that tell you *how many buyers of your products* your advertising can sink its teeth into through any given magazine. "A buyer in hand," a modern proverb would tell us, "is worth a hundred whose office doors and minds are closed."

Consider, then, these facts about *American Machinist*. Alone among all metalworking magazines, it gives you this:

1. Over 34,000* self-elected, paid subscribers . . . whose invitation to enter their open office doors *and* minds is *yours* every time you advertise in the magazine they welcome above any other. They aren't *all* the buyers in Metalworking . . . but they are by far the largest number of subscribers any metalworking magazine has ever offered . . . and their concentration on the production-executive level makes their buying voice the most important and often-heard in their industry.
2. The constant, helpful backing for your advertising that Metalworking's most-sought-after editorial pages are exclusively equipped to give. The most valuable start your advertising can have is an introduction by one of your prospect's best-liked and most-respected friends. And the record of *American Machinist's* unmatched paid-circulation growth is your assurance of where this magazine's editorial pages stand with Metalworking's production executives.

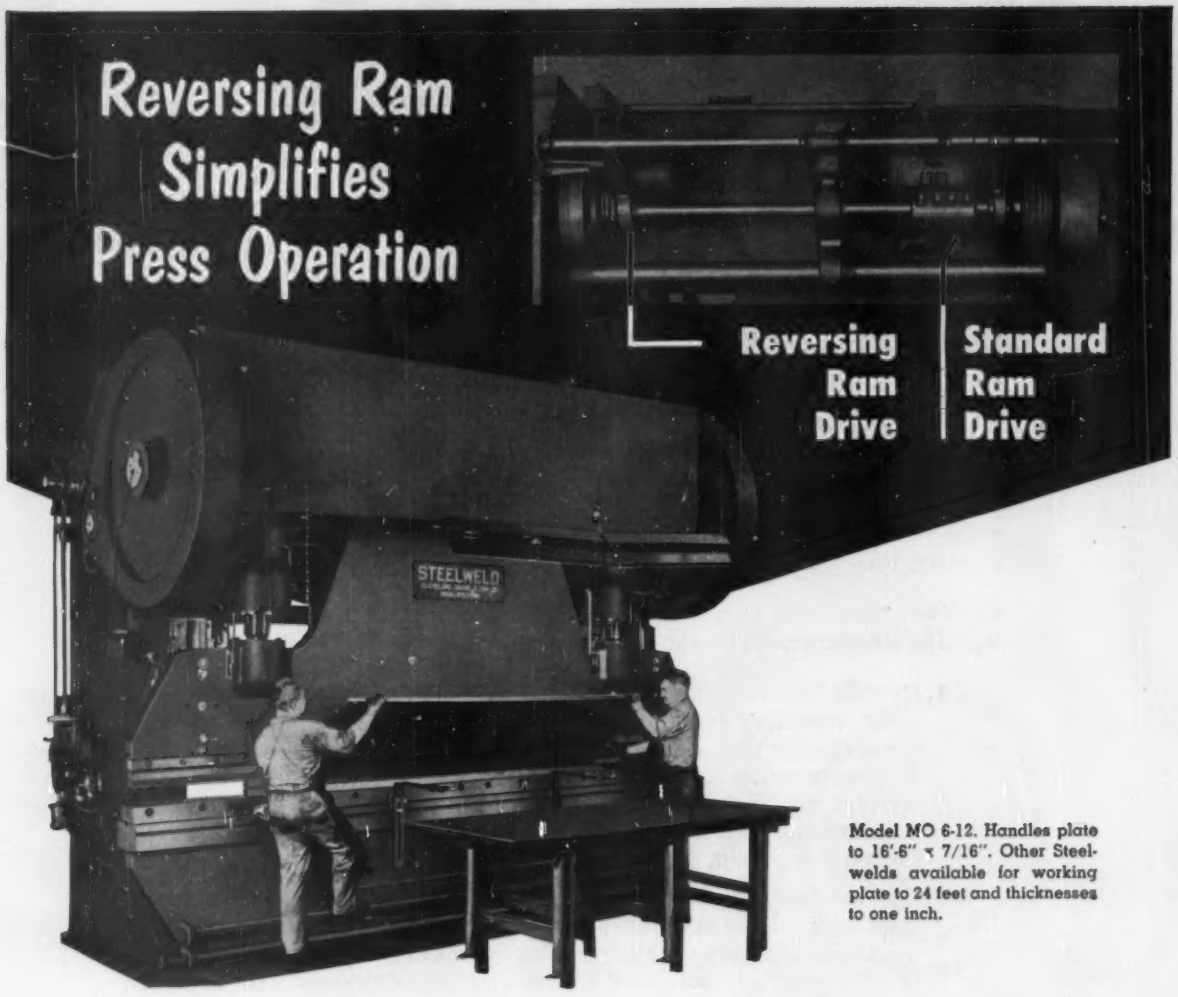
If you sell to America's biggest industry, and haven't heard the full *American Machinist* story lately, it will pay you to know it. Any *American Machinist* representative will make the proper introduction at your convenience.

*Subject to ABC audit. Net-paid, ABC circulation in December, 1953 was 33,000

. . . behind your products

THE McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION
McGRAW-HILL BUILDING, NEW YORK 36
PUBLISHED EVERY OTHER MONDAY
MEMBER OF THE AUDIT BUREAU OF CIRCULATIONS
AND ASSOCIATED BUSINESS PUBLICATIONS

Reversing Ram Simplifies Press Operation



Model MO 6-12. Handles plate to 16'-6" × 7/16". Other Steelwelds available for working plate to 24 feet and thicknesses to one inch.

With a reversing ram drive you can back the ram or upper die away from the work at any point in the stroke. It is not necessary for the ram to continue through in one direction as when only the normal press drive is provided.

This feature speeds locating the correct ram position to achieve a specified bend or shape. It saves time and spoilage when trying new dies.

Reversing ram machines have two complete drives, including motor, flywheel, clutch and brake. They are controlled by individual foot pedals on two different shafts, located one above the other across the front of the press.

The reversing ram feature is optional and may be provided on any Steelweld Bending Press. It adds greatly to the ease of operation and because of time-savings it enables, rapidly absorbs the extra original cost.

Steelweld Bending Presses are such versatile tools with so many outstanding features that we urge you to learn all about them. As a starter, send for the catalog below.

GET THIS BOOK!

CATALOG No. 2010 gives construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.

1457 EAST 281 STREET, WICKLIFFE, OHIO

STEELWELD

BENDING PRESSES

BRAKING • FORMING • BLANKING • DRAWING • CORRUGATING • PUNCHING

For Those Tough Special Jobs
Depend on

National Tool Co.

Years of successful experience in special tooling and related production problems are yours for the asking. When the job requires special cutting tools call in your National Tool Co. representative. He is backed by more than 49 years experience in the engineering and manufacture of special cutting tools. His assistance is yours, without obligation, whether you're interested in one tool or a complete tooling program.

National Tools Cleveland

National
TOOL CO.
Cleveland 2, Ohio

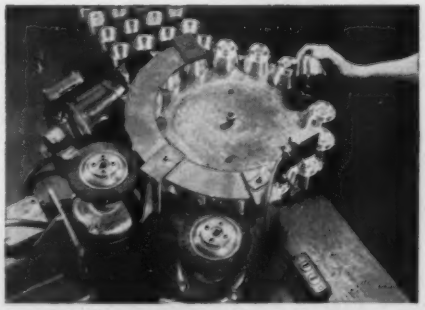
OSBORN

Cuts costs. Here, push-button brushing finishes both sides of brass discs at a rate of 15,000 per day. Does a more uniform job many times faster than former hand method.

This study of *your* operations could save you thousands of dollars

Every day, Osborn Brushing Specialists make startling improvements in production jobs such as shown above. They do this by studying cleaning and finishing operations and making an **O**sborn **B**rushing **A**nalysis . . . a written report with recommendations on all jobs which can be improved with the latest push-button brushing techniques.

An **OBA** in *your* plant may save you thousands of dollars. It won't cost you a cent. Ask for an **OBA!** Call or write *The Osborn Manufacturing Company, Dept. C-22, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

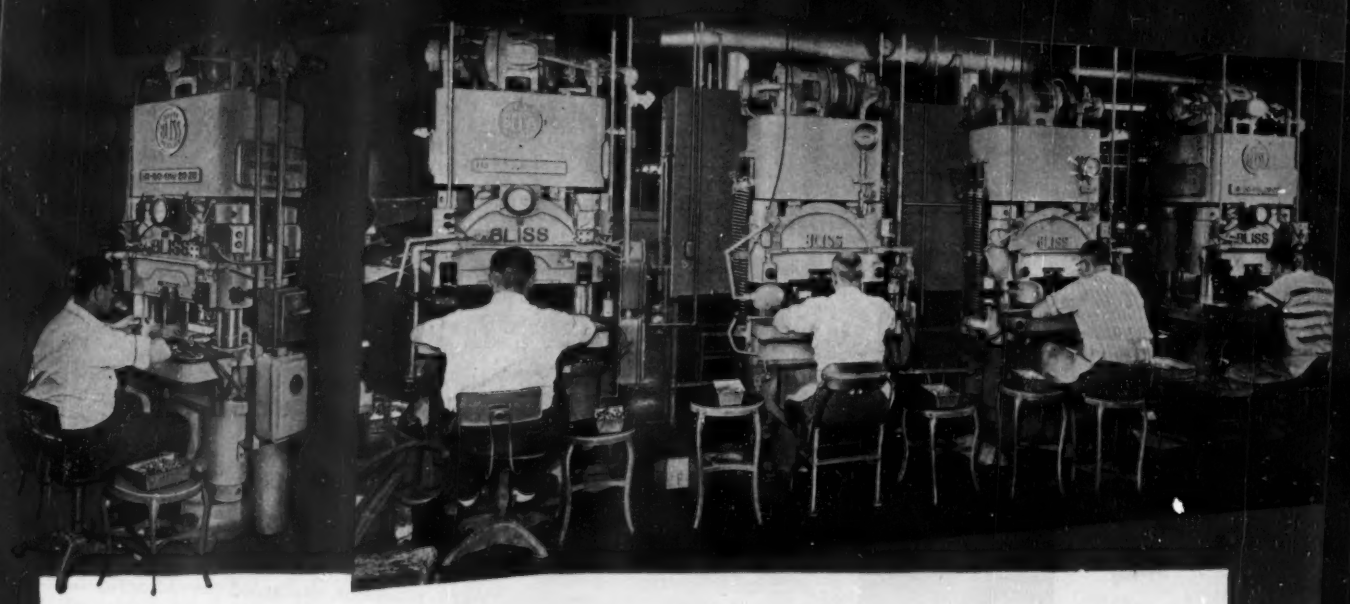


Saves 74%. A manufacturer of aluminum components is now removing burrs and blending surface junctures of parts at a rate of 1400 per hour, compared to 360 with former hand method.

Osborn Brushing Analysis

TO HELP YOU DISCOVER HIGHER QUALITY AND LOWER COSTS WITH POWER BRUSHING

For HYDRAULIC presses, too . . .
it pays to specify BLISS



Gruen obtains MICRO-PRECISION accuracy with

BLISS HYDRO-DYNAMIC PRESSES

Accuracy is the keynote of operations at the Gruen National Watch Case Company, Cincinnati, Ohio. This is especially true in the forming of the case itself. Here, tolerances are critical—with an exact fit of the crystal inside the watch case essential to keep it from falling out. Gruen prefers the Bliss Hydro-Dynamic presses for this job—holding tolerances to several ten-thousandths of an inch.

Equipped with high- and low-pressure pumps, these Bliss Hydro-Dynamic presses are the moving-up type . . . especially suited to industries employing sub-die processes. Their efficient, accurate operation is typical of results obtained with Bliss Hydro-Dynamic presses in all types of plants. At Gruen, *72% of the presses are Bliss-built.*

Let Bliss, the world's largest press builder, apply its long experience to *your* next press problem. Talk it over with a Bliss sales engineer. He can help you select the right press for your special requirements. Meanwhile, for more detailed information about Bliss Hydro-Dynamic presses, write for Catalog 30-A.

BLISS **on your press is more than a name . . . it's a *guarantee***

Keep Your on the OLIVER Line — Cost Cutting Production Boosting MACHINE TOOLS

OLIVER DRILL POINTERS

Properly machine ground drills give better performance. OLIVER Drill Pointers, with each lip doing equal work, give balanced cuts—more accuracy—more perfect holes—more efficiency—longer drill life.

As Illustrated:

No. 21 Oliver Bench Drill Grinder. Hand operated for Drills No. 57 to ½".

No. 510. For Drills ¾" to 3" —2-3-4 flute.

OLIVER DIE MAKING MACHINES

Efficient, speedy and accurate — effecting great savings in time and costs. Skilled labor is not required for sawing, filing and lapping operations.

Available in 5 Models.

Bench Model S-1 (Illustrated) — Single Speed Die Maker for use on Tool Steel up to 1" Thick.

Heavy Duty Model (Illustrated) — 6 speeds, works in metal up to 3" thick, has variable strokes to 5" with Hydraulic feed.

OLIVER ACE UNIVERSAL TOOL & CUTTER GRINDERS

Keep your most difficult cutters sharp with Oliver ACES. They excel on high speed and Tungsten-Carbide work. Direct reading for clearances reduces fatigue — eases operators' jobs.

The ACE excels for grinding face mills up to 15" —also, slab mills • slitting saws • all types cutters and reamers.

2 Models: Heavy Duty (Illustrated) and Standard.

OLIVER 20" TEMPLATE TOOL BIT GRINDER

Efficiently powered by a 3 h.p. motor, this OLIVER Machine grinds on the periphery of a 20" wheel. Capacity: tools up to 1½" wide x 1¾" high from 0 to 20° clearance. The OLIVER is developed for production sharpening of single point Tungsten-Carbide and high speed tools—offers increased production, lower tool costs and savings in man-hours. Extremely fine finish assured.

Write Today For Complete Information

OLIVER INSTRUMENT CO.

1410 E. MAUMEE · ADRIAN, MICHIGAN

Backlash

EXTRACTS FROM CURRENT LETTERS TO THE EDITORS

Sprechen Sie Deutsch?

As a reader of your magazine I would like to tell you what a positive impression it has made on me. Articles such as Practical Ideas, or concerning toolmaking capture my special interest. Here, in Germany, it is hard to find a magazine which deals with the problems of the toolmaker. I therefore anxiously await each new issue, which I am able to borrow from the America House in Wiesbaden.

It is clear to me that American tool engineering is far ahead of ours as regards cutting, drawing, stamping, and plastic tools. From many of the illustrations of cutting tools, it is clear that many concessions are made in favor of practice, while with us, outdated ideas still receive first consideration.

I would like to ask you a favor. Could you put me in touch with an American toolmaker with whom I could discuss toolmaking problems?

Hans Schumacher
Dalbergstrasse 7
Mainz, Germany

Would anyone care to engage in correspondence with Mr Schumacher? His original letter was written in German, and he explains that his English is not too good, so it had better be someone who reads and writes German.—Ed.

He Lives

No, Mr Herndon, Old George is not dead (*AM* — July 5 '54, p93). And I do not believe he will ever die—at least not so long as human skill is needed to form and shape metals. Your trouble is that you forget we live in a changing world. George has changed, too, so you fail to recognize him. He has shaved off his walrus mustache, discarded his old derby in favor of a snappy, wide-brimmed Stetson, and does his foreign traveling via the medium of technical magazines. And, oh yes, he has had four years of high school and perhaps a year or two of college.

But he is still the same George. True, he doesn't do things in a certain way because some guy in China showed him how. He read about it in a magazine and understands the principles involved. He can still operate any machine in the shop, but

GRINETICS

By D G SMITH

FLUID MOTOR

CUTTING TOOLS

COMBINATION SQUARES

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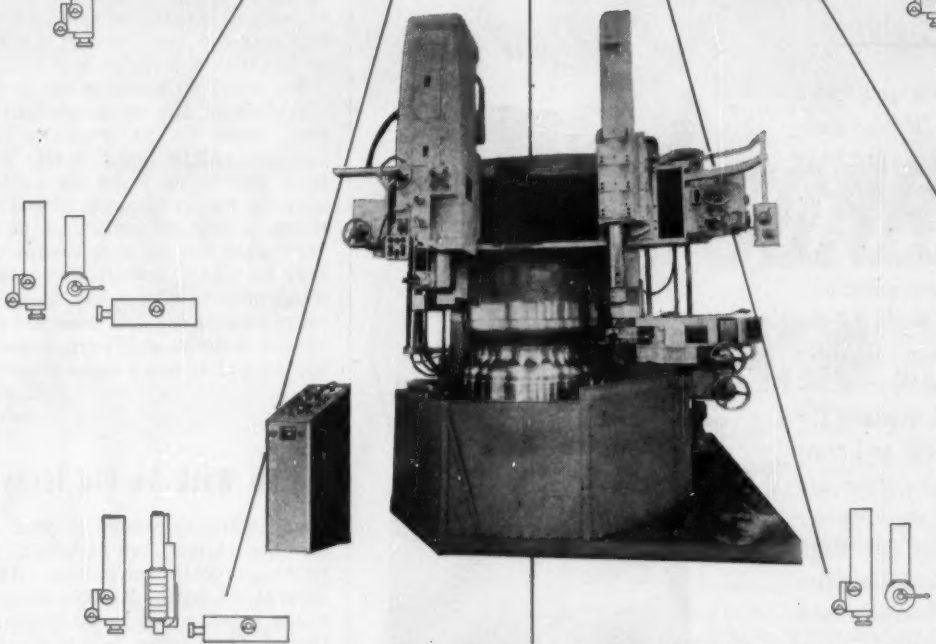
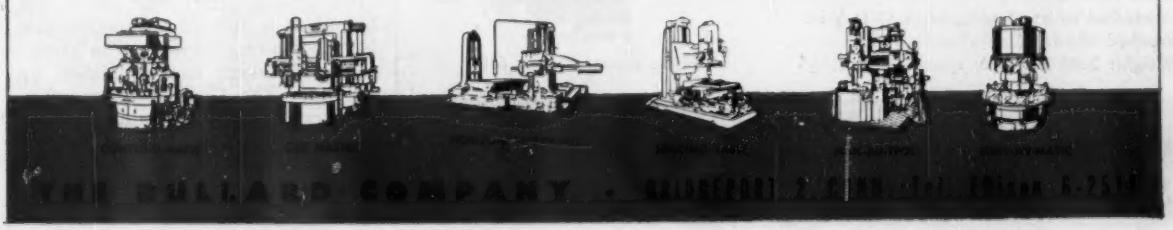
BULLARD

GRINDING AND TURNING COMBINATIONS
THAT WILL PAY YOU ON THE

VERTICAL CHUCKING GRINDER



Grinding to tolerances of .00025 as determined with an electronic measuring instrument, are obtainable on Bullard Vertical Chucking Grinders. Such tolerances have been previously considered impractical on large size work. Versatility for facing or turning operations when required is available with nine different head combinations as illustrated. This demonstrates the flexibility of this superb machine to meet your particular manufacturing requirements . . . A Bullard sales engineer will gladly give you full details or write to The Bullard Company, Bridgeport 2, Connecticut, Telephone, ED 6-2511.



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Finger-tip level controls for easier operation; one-piece column casting mounted *on* the base for maximum rigidity; hand-scraped ways for accuracy; telescoping dust plates for protection of vertical and cross feed mechanisms — these are but a few of the many improvements designed by our engineers to make Reid Grinders a standard of precision and dependability.

If your toolroom still harbors a surface grinder like those above, for the sake of efficiency,

PLAN NOW FOR REPLACEMENT!

Condensed specifications — Model 618V
Capacity: 6" x 18" x 17¼" (spindle center to table)
Work table: 51" x 8"
Power-feed table: variable, 12 to 35 ft./min.
Standard wheel: 7" x ½" x 1¼"
Weight: 2100 lbs. Floor space: 71" x 43½"

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Please request Catalog 618-1

Reid Brothers Company, Inc.
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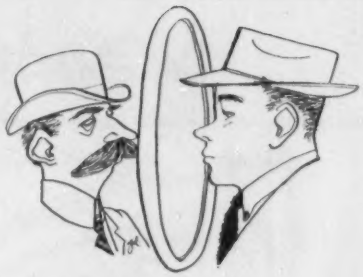


he can turn out work to limits of accuracy the earlier George never dreamed of. No longer does he brag of his ability to "feel" a difference of a "thou" with his calipers — instead he glances at the screen of his comparator or peers through the eyepiece of his machine's optical system and casually adjusts the knob that makes a correction of a tenth, or less than a tenth, of a thou.

But make no mistake! He is still a craftsman. His tools are still as well cared for as were the old George's, and he can do things with them that would make the old boy raise his hat in admiration. The old fellow would be sadly lost in today's shop, but the new George has kept pace with modern technology. New frontiers open before him with every passing day, and there are still endless volumes of adventure awaiting the leafing of his eager fingers.

J H Cowley
Detroit

New Work On Old Ideas

I am greatly interested in your description of the Grob success in the forming of gears and splines (*AM*—June 21 '54, p169). It takes me back to the experiments by Anderson, in Dayton, Ohio, when he was superintendent of the Stoddard-Dayton automobile plant. (I think there were two plants in Dayton at the time and I'm not quite sure which he was with). He began by using lead to try out his method. Later, he opened a plant in Cleveland backed, I was told, by Col Lewis, of Lewis machine gun fame. I spent a day with him there and saw him roll gears that seemed to be good. I understand he made some for Dodge.

Of course, this was with hot blanks. It is difficult to imagine how it is done with cold stock. The Anderson gears were easily finished by grinding. The Grob gears seem to need no further machining. What a change this could make in the machine equipment of automobile and other shops! The show piece of the Anderson gear rolling plant was the

making of herringbone bevel gears with no groove between teeth of opposite angles.

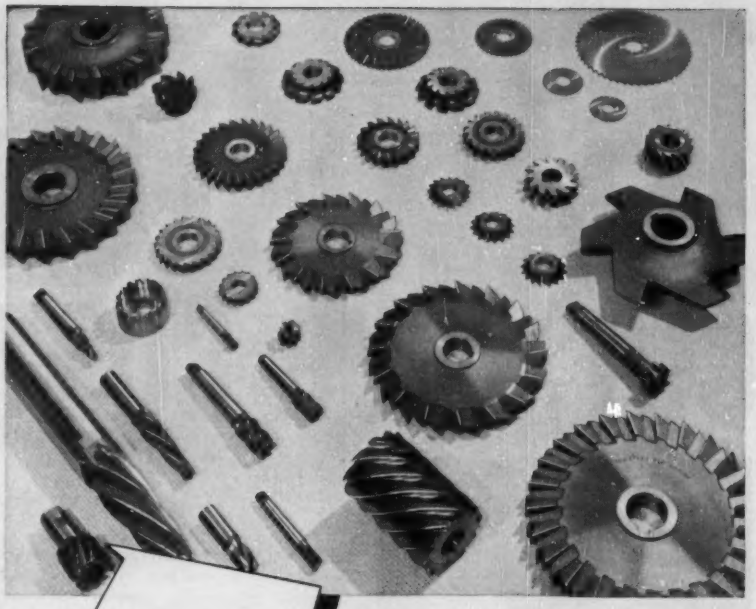
Another revolutionary change came with the introduction of honing of automobile cylinders. Prior to that, every auto shop had batteries of planetary grinders, for finishing cylinder bores. When honing became accepted practice, these disappeared almost overnight. But, instead of putting Heald out of business, it stimulated him to devise other machines—and see how the business has grown.

The first honing I ever saw was in the Stearns plant in Cleveland, and was devised by the superintendent, whose name I do not recall. This was really a polishing operation, as the sticks of honing abrasive merely floated and did not correct any irregularities of diameter or straightness.

I also recall the early attempts at molding small parts from powdered metal, and knew some of the engineers on the work. This has now grown into much larger proportions and may some day rival the cold-rolling process—although it hardly seems likely.

Another experiment now being tried is plating the bores of aluminum cylinders with chromium, which may make possible much lighter engines. About 1919 I saw aluminum cylinders with the bores plated with cast iron in the Cleveland plant of the Aluminum Co. These were for Franklin cars, as they aimed at lightness in every detail, but apparently they did not work out satisfactorily. It is interesting to see how many of the "wild" ideas of a few years ago have become standard procedure today.

Fred H Colvin
Point Pleasant, N.J.



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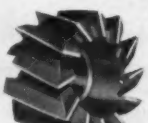

For profitable solutions to production milling problems, call on Gorham! Over thirty years' experience in creating fine cutting tools is your assurance of satisfaction.

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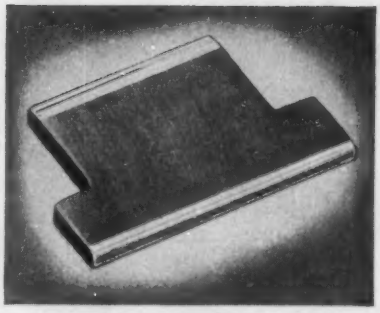
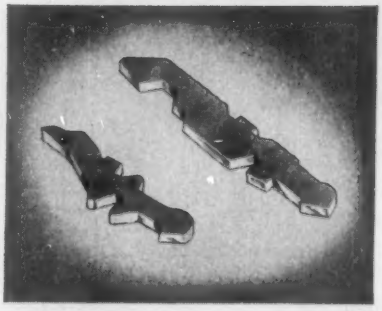
Unified Broaching

COLONIAL

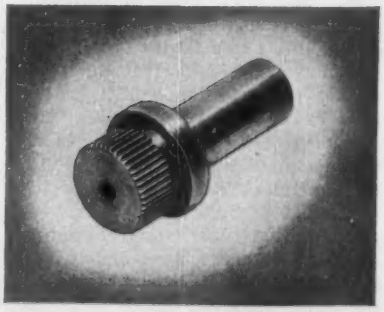
TEN TIMES FASTER than previous methods—broaching top and bottom radii on these automatic transmission reverse band anchors is helping one manufacturer lower the break-even costs. The design called for both edges to be rounded with a taper leading into one of the rounded edges. Besides increasing production by 10 times, the broached surfaces are more accurate, and costs are kept to a minimum. Thousands of these band anchors are being machined between broach sharpenings.

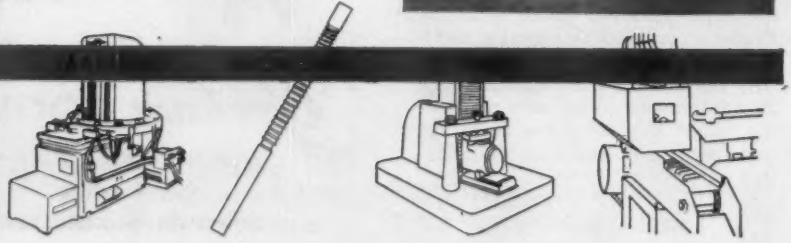


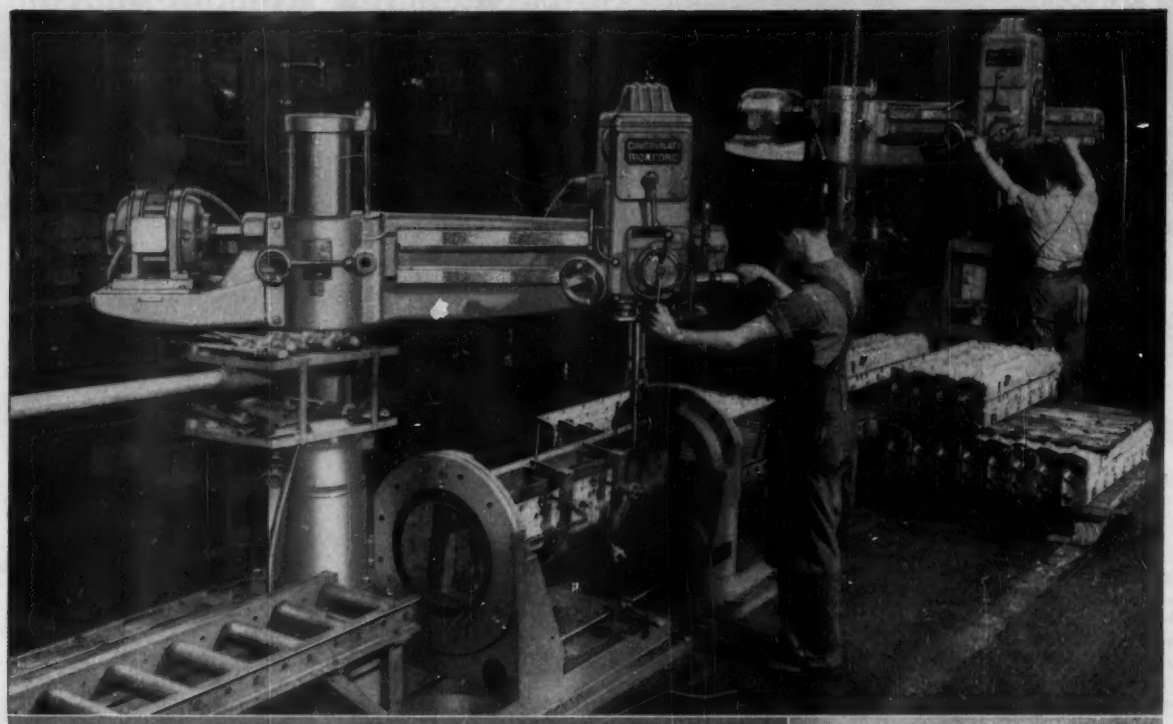
THIRTY TIMES FASTER than milling—broaching lowers costs in the production of the intricate shapes of these copper breaker points. Seven pieces at a time are broached at a rate 30 times faster than by milling. 75,000 pieces are completed before it is necessary to sharpen the broach. 800 to 1000 pieces per hour are broached on one Colonial machine with only two sets of Colonial broaches.



TWENTY TIMES FASTER than other methods—the serrations on the end of this shaft are cut with a button broach in a single pass. Cost per part is reduced substantially because broaching is 20 times faster. This, and hundreds of other applications on file at Colonial, are ample testimony of the tremendous cost-cutting potential that can be yours by utilizing "Unified Broaching" by Colonial. Send us prints of your parts—let us show you how to cut costs over your present machining methods.







3 years of operation with NO MAJOR MAINTENANCE...

Photos courtesy Caterpillar Tractor Co., Peoria, Illinois.

Camshaft Housings for new Caterpillar DW21 Wheel-type Tractor illustrated in insert picture, showing casting before and after drilling operations.

The performance of Cincinnati Bickford Super Service Radial Drills at Caterpillar Tractor Co. has been outstanding, steady and trouble free.

On this job, including drilling, tapping and reaming, 116 holes are produced, 14 are reamed within .0005″ tolerance. Caterpillar Tractor Co. also states Cincinnati Bickford Super Service Radial Drills have contributed to the advancement of their product.

Write for Catalog R-21-C.

80 YEARS OF SERVICE

CINCINNATI BICKFORD

RADIAL AND UPRIGHT DRILLING MACHINES

THE CINCINNATI BICKFORD TOOL CO.

Cincinnati 9, Ohio, U.S.A.

New KING VERTICAL BORING & TURNING MACHINE

at THE AKRON STANDARD MOLD COMPANY

Machines "KING SIZE" Tire Molds

25% Faster!

At right — "Akron's" 120" KING machining huge tire mold. *Below*—Close-up view showing forming cut being taken in the mold, amply demonstrating KING "heavy-weight" power and rigidity.

The Akron Standard Mold Company of Akron, Ohio, a KING® Vertical Boring & Turning Machine customer of long standing, recently purchased the 120" KING shown above for manufacturing giant-size tire molds. The mold being machined is size 30.00 x 33, the largest size mold this company has made to date—so large, in fact, that the forming tool had to be made in three separate pieces in order to complete the contour.

Mr. W. P. Voth, President of The Akron Standard Mold Company, reports this new KING "amply fulfills our requirements . . . and turns out work even faster than we anticipated." Mr. Voth estimates that this new KING has increased production on large size molds by 25%.

Here is more on-the-job evidence of typical KING performance . . . the kind of evidence that explains why KING today, as in the past, is industry's logical first choice for fast, accurate, profitable production. KING Machines are made in 10 sizes, 30" to 144", in a wide variety of head combinations. See your KING Distributor, or write to us direct, for complete specifications and illustrated description of construction features.

American Steel Foundries

KING MACHINE TOOL DIVISION

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Spot News of Metalworking . . .

- **ULTRASONIC TESTING OF TITANIUM . . .**
  Testing for existence and location of flaws in titanium with the "sound echo" technique is being done by Republic Steel Corp.

- **STRUCTURAL SANDWICH . . .**
  Leading edges, wing tips and other structural aircraft parts are now being built with "sandwiches" of honeycombed material between sheets of metal or plastic-impregnated glass fiber.

- **DIAMOND RECOVERY . . .**
  Navy is working on a method to recover diamond bort from industrial diamond waste: electrostatic separation (diamonds will take a bigger electrostatic charge than most materials, can thus be separated from other minerals).

- **NEW TAX LAWS . . .**
  Manufacturers will have a say-so in formulating new liberalized-depreciation regulations. Internal Revenue Service will make up and publish some 60 new regulations, then hold a public hearing for objectors. Basis for the useful life of plant and equipment will still be the controversial Bulletin F.

- **RED EMBARGO . . .**
  Under terms of the new East-West embargo, the US will have a single "positive list" of embargoed items, including machine tools, that can't be shipped to Iron Curtain countries without a license. The US, unlike England and France, won't have "gray" classifications of goods that can be shipped under special circumstances, or in limited quantities.

- **FRINGE BENEFITS . . .**
  Reports from 940 companies to the US Chamber of Commerce show that fringe benefits averaged $720 per worker in 1953 — $76 higher than in 1952.

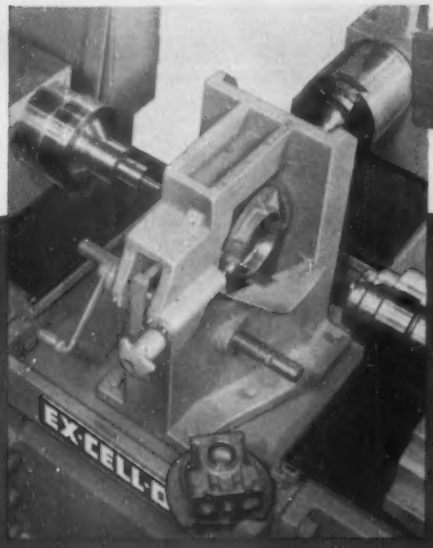
- **HOUSE CLEANING . . .**
  Following charges made by a Congressional investigating committee that 10 members of the Seattle Machinists' Union 79 are communists, the Union has set up its own six-man investigating board. Its object: to file charges against any communist party member or advocate of communism.

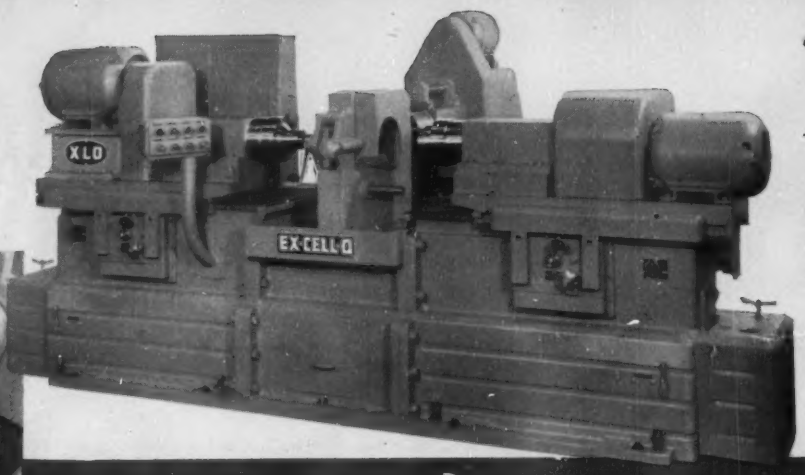
- **SECONDARY BOYCOTT . . .**
  CIO Auto Workers are up in arms over this one: in May '53 a strike at Ford's Canton, Ohio, forge plant idled some 5700 of Ford's Michigan workers, too. They promptly applied for unemployment compensation, have just been ruled down. Says UAW, "It has been held that a strike in another state disqualifies claimants laid off through no fault of their own in Michigan."

- **THE FINNS AND THE REDS . . .**
  Not content with her trade pact with Russia, signed June 21, Finland would like to do $25 million more business with the Soviet Bloc — particularly Red China. If negotiations for a supplementary pact go through, Finland will export metalworking products to China, will be paid in Russian rubles.

Ex-Cell-O 3-Way Precision Boring Machine. Standard way units—tooled to suit the work.

Note the simplicity of this tooling.





Cut Costs—Combine Operations

. . . INSURE YOUR PROFITS in Today's Competitive Market

Heavy lines show the machined surfaces. Small single triangles indicate single operations; double triangles indicate rough-and-finish operations.

Once a part is properly located and clamped, it's good practice to do as much machining on it as possible before it's moved! Related dimensions are held closer, handling time minimized and production increased.

This Ex-Cell-O 3-Way Precision Boring Machine performs 5 roughing and 18 finishing operations on a cast-iron crankcase used in the refrigeration industry. Tolerances are extremely close on the crankshaft and cylinder bores. Net production for the roughing operation is 33 parts per hour; for finishing, 36 parts per hour.

Ask your local Ex-Cell-O representative about all the other advantages of Ex-Cell-O Way Machines—or write today for Bulletin.

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54-30

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MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

Washington . . .

Boeing has landed an Air Force order for 29 jet tanker-transports, military counterparts of the jet transport plane Boeing is testing for non-stop transatlantic airline operation. The order comes to about $174 million—out of fiscal 1955 funds—for tooling, engines, and other government equipment to be furnished. In addition, the Air Force has agreed to take 59 more from Boeing later on.

The new order is a big boon to Boeing. It gives the firm a head start on production tooling over the US planemakers for civilian jet transport, weakens the time advantage held by British firms. Besides, it puts Boeing on the ground floor in future Air Force jet tanker programs.

Tooling needed to build the Air Force transport will be used when Boeing gets into the airline jet market on a big scale. Boeing will have its tooling for commercial jet transport just as it had C-97 tooling for its commercial Stratocruiser.

• • •

FOA has held up placement of orders for $20 million worth of steam locomotives and railroad freight cars for shipment to India. Bids have been in for more than a month. The delay in letting contracts stems from strong politicking by US manufacturers. Low bids for the locomotives were made by a pool of Japanese builders: for the freight cars by both British and Japanese manufacturers. In both cases, the lowest US bid is more than double the foreign low bid.

Some months back, FOA instructed GSA to buy the equipment on such a competitive basis. This was tantamount to closing the door on US firms. FOA and the State Dept were firm on the policy of making bids competitive on a world-wide basis. But later, FOA backed down a bit, allowed a 10% price differential for US bidders in labor surplus areas.

But this didn't mean much. The US low bidder on the steam locomotives (Baldwin-Lima-Hamilton) isn't in a distressed area.

• • •

New rules on taking faster amortization of machines and equipment are being drawn up by Internal Revenue Service. These will be among the first of the detailed regulations to be announced under terms of the new Internal Revenue Code. The administration is counting on faster amortization to help spark a business up-turn this fall, so the new regulations will be pumped through bureaucratic channels as fast as possible.

No use sending your own questions about the new tax law to Internal Revenue. No one there can answer detailed inquiries until the regulations are written. Congress only set out broad policy in the law. Actual application of the policy is spelled out by Internal Revenue itself in the regulations.

Machinery makers interested in the new amortization rules will get a chance to speak their piece before the regulations become final. Here's the procedure:

First, Internal Revenue draws up a tentative regulation. It is published in the *Federal Register*, with a date for a public hearing. You can either attend the public hearing, or write a letter giving your views. After the hearing, the regulation is drawn up in final form and is published again in the *Federal Register*. You can subscribe to the register for $15 a year, from Superintendent of Documents, Washington 25, DC. You can also keep track of the new rules by subscribing to the *Bulletin of the Internal Revenue Service;* $4.50 a year, from Superintendent of Documents. Altogether, there will be about 60 new regulations drawn up.

After a regulation is adopted in final form, tax officials can answer detailed questions. They are getting set for a flood of mail. If you make your inquiry specific, based on your own tax problem, you'll get what Internal Revenue calls a "ruling." This can be used as a guide in making out returns under the new law.

• • •

ODM's plan to grant five-year tax writeoffs to defense industries for "modernizing" facilities has bogged down. Commerce Secretary Weeks and Treasury Secretary Humphrey, members of the inter-agency Defense Mobilization Board, which must okay the plan, are against it. Says Weeks: the government has "gone as far as it can" to promote defense expansion with fast tax writeoffs.

The plan would have allowed producers of defense goods to write off in five years costs to modernize existing facilities—even though installation of new equipment does not actually boost capacity. Idea was to encourage defense producers to replace old equipment in order to cut production costs, generally make for more efficient production. Right now, the five-year writeoffs are allowed only if there's a net increase in capacity.

• • •

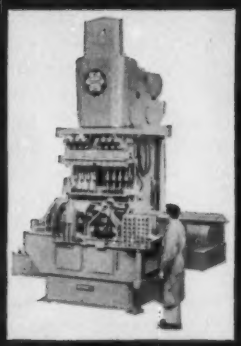
Don't throw away your Korean price and wage control records yet. Regulations say you must keep the files intact until next April. Many firms have asked Washington if it's okay to destroy the records now, complaining that the files take up valuable storage space. ODM is warning them not to, says there's still a chance that a government investigator might want to take a look at them.

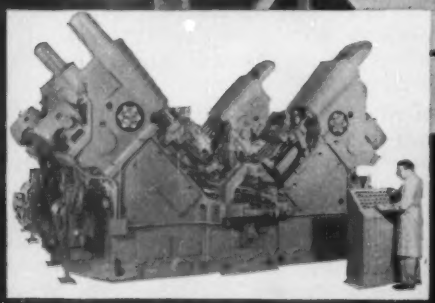
FOR

Production • Accuracy • Economy

V-8 Cylinder Blocks are MICROHONED Automatically on NEW Model 420 Hydrohoners ☆

Specifications of this model are included in our general catalog—obtainable at the offices listed below.





This multiple-spindle, heavy-duty model is designed to fit any type of production line. Examples of its adaptability: above, two four-spindle machines with tip-up fixtures; left, V-type; upper right, eight spindle vertical.

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Detroit . . .

In July 1952, Ford announced it had begun work on a $2.5-million contract to design, develop, construct and test quarter-ton experimental military vehicles for Army Ordnance.

Completion of the project is now near. The Ford vehicle is believed to be not unlike the Willys Jeep in appearance, but may be a superior performer. The Ford vehicle, undergoing extremely severe tests, is believed to have outlasted earlier Willys models by a definite margin.

Of equal interest is the fact that the contract let to Ford specified that the experimental vehicle or vehicles were to be entirely new—new frame, suspension, body and engine, plus an attempt to improve power-to-weight ratio.

Under the contract, Ford was to try to obtain for the government proprietary rights to all parts and components of the experimental vehicle. It is believed that Ford has succeeded: Where it could not obtain proprietary rights from component suppliers, it designed a new component, circumventing existing patents, and will relinquish to the government rights to such newly developed parts.

Whether a production contract will be let is not known.

• • •

1954 has been characterized by George Mason, American Motors president, and others as simply a year of "adjustment" for the smaller auto makers.

It certainly has been all of that. "Adjustment," perhaps, is not a proper definition, since it implies continued operations for the Little Three—and Kaiser-Willys' position seems still to be in doubt.

Packard, Studebaker, Nash, Hudson, Kaiser and Willys are struggling through one of the worst years they ever encountered. They'll do well to finish 1954 with as much as even a dismal 5% of total industry sales.

Their plight, in part, is traceable to a failure to modernize plants and equipment as extensively as their larger competitors, and an inclination to accede too readily to demands of labor unions.

Now comes the reckoning. First Kaiser at Willow Run had to ask CIO's Auto Workers to grant the company financial relief by paring pay scales and fringe benefits. The request later was repeated at Willys, and more recently, Studebaker sought and obtained contract revisions that will cut labor costs.

• • •

Similar economy axes are being whetted elsewhere. Packard is preparing to ask the union for a more realistic contract when the present pact expires next year.

American Motors Corp also proposed changes to the union which would enable Nash and Hudson to bring productivity rates up nearer the levels enjoyed by Ford, GM and Chrysler. AMC's proposed alterations deal with lost time, standards, seniority provisions, etc.

Meanwhile, Kaiser-Willys, which recently negotiated changes which cut pay about 5%, apparently will go back to UAW to ask for still more concessions. K-W's average hourly rate, according to a company spokesman, is about $2.22, plus fringe costs totaling about 26 cents. That rate, considerably in excess of industry averages, will have to be reduced, of course, if K-W is ever to compete directly.

While the Little Three—through merger economies and reduced labor costs—will assuredly be better able to mix it with the Big Three, 1955 gives indication of being as tough for them as this year has been.

• • •

Industrywide, at least nine new body shells will appear, and four new engines are due, plus a number of major mechanical changes. Modest price cuts may come—if not in actual list price reductions, then by taking some devices off the optional-at-extra-cost list and making them standard equipment.

• • •

Another factor auto makers must face up to in '55: UAW's upcoming demand for guaranteed annual wages. On the record and privately, auto executives say GAW is one demand they will not entertain. UAW officers are equally committed to obtain it.

The intra-union political aspects of recent and proposed wage cuts will still be on the minds of union leaders next spring. They will be determined to make a "comeback."

Chances are still good that Ford will be UAW's target for GAW. Unless compromise can be achieved, a strike the size of which has not been seen in Detroit since 1950, when Chrysler was down for 100 days, surely will ensue. In that case, a full 30% of the auto market—Ford's present level — would be up for grabs.

1955 is the year Ford officials originally cited as the period when Ford would make its real run on Chevrolet. Somewhat to everyone's surprise, Ford carried on the tremendous sales surge it exhibited in the last half of 1953 and has been shoulder-to-shoulder with Chevvy all year.

In fact, at latest count, the Dearborn auto maker had regained—by several thousand units—the sales lead from Chevvy. Both companies will be very "hungry" going into 1955, and probably will be inclined to deal generously with the union — except on the issue of GAW.

Another Duplex Milling Machine

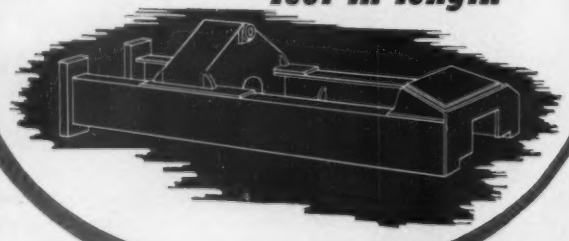
BY MOTCH & MERRYWEATHER

Fifty Years 1904 - 1954

STANDARDIZED TRAVELING HEAD DESIGN is adapted to *Many Specialized Jobs*

A Motch & Merryweather Duplex Milling Machine finishes the pads of an 8-foot tractor frame. A second frame (rear) is loaded while the first frame (front) is milled.

... especially for Large Parts 6 feet to 11 feet in length



Again using the facility of *traveling milling heads* instead of traveling fixtures, Motch & Merryweather creates greater universality; saves time, original cost and floor space. Standardized design enables duplex operation to dispatch a wide range of work with money-making speed and accuracy. Simplified fixturing is readily adjustable to handle parts of varying size. May we study your requirements?

THE MOTCH & MERRYWEATHER MACHINERY CO.

MACHINERY MANUFACTURING DIVISION

CLEVELAND 13, OHIO

Builders of Circular Sawing Equipment, also Production Milling, Turning and Special Machines

Machine Tools . . .

Interchangeability of tooling is one of the major objectives of a plan, now in its preliminary stages, for getting the aviation industry and machine tool builders to agree upon standardization of certain features of machines so that the same aviation parts can be machined on any make of the same size and general type of machine.

The plan is being pushed by a number of interested parties. The Aircraft Industries Association gave it the initial impetus.

The Air Force and Navy Bureau of Air are strongly supporting it, too. And the Business and Defense Services Administration is offering its offices to bring about the desired objective.

• • •

Skin millers are the first type of machine to be considered. Makers of skin millers already have met with representatives of aircraft companies at Denver, Colorado.

A task force of the skin milling people will have met in Washington, with BDSA cooperating, before you read this page.

If standardization is agreed upon, the way will have been cleared for a study of war mobilization needs, with the possibility of bringing into being the number of machines required for the agreed-upon production capacity.

• • •

Other critical types of machines will be taken up one by one, if and when the work on standardization of skin millers is successfully completed.

This program, if carried out as extensively as some government officials envisage, might well lead to large machine tool orders placed by Washington along the lines advocated in the Vance Plan.

Funds now in existence can be drawn upon for such a project, the funds running into hundreds of million of dollars.

• • •

James C Kelley, for the past few months deputy director of the Metalworking Equipment Division of BDSA, has been appointed general manager of the American Machine Tool Distributors Association.

He will take office sometime in October and will have his headquarters with the Fernley organization in Philadelphia.

Thomas Fernley Jr will continue as secretary of AMTDA.

Mr Kelley is a native of Sidney, Ohio, was with Monarch Machine Tool Co, and for many years was connected with machine tool procurement in the Navy Department in Washington.

He is well known throughout the machine tool industry and has a wide acquaintance in the armed services and in other government agencies.

The new US embargo list of what cannot be shipped behind the iron curtain is not the same as that of Britain and other European countries.

The Europeans have an embargo list, a quantitative control list, and a "watch" list.

Machines on the quantitative control list can be sold to Russia only in limited numbers.

Machines on the "watch" list can be shipped to eastern Europe in any quantity desired, except that the western European governments will watch this traffic carefully.

If the volume should become excessive in any item, that item probably would be transferred from the "watch" list to quantitative control or to the actual embargo list.

• • •

Washington, by contrast with London and Paris, has no intention of trying to administer three classifications of strategic goods.

The United States will have a single "positive" list of embargoed items, including machine tools, that cannot be shipped behind the iron curtain without a license.

All items on the European quantitative control and watch lists (which European builders will be able to ship to Russia) will be on the US "positive" list (embargoed).

• • •

It is possible that if an American builder should seek an export license for iron curtain country shipment for an item on the European quantitative control or "watch" lists, the license might be granted. But that is sheer speculation.

An American manufacturer, it can be presumed, will be able to get a license for delivery to Russia of a machine not on the "positive" list.

Washington, however, has not given any clear-cut interpretation of this point, and probably won't.

• • •

License still must be secured for export of machines to our allies, including Britain. Purpose of the licensing is to find out exactly where the machine is to be installed and to make sure that it is not trans-shipped to Russia.

Examination of the new embargo policy raises many questions about what can be shipped behind the iron curtain and what cannot. It is a good guess that Washington is deliberately being less than precise in its rules and definitions. This is regarded as good cold-war policy.

Red buyers and western exporters may have to find out for themselves what is allowable. They will be compelled to watch what export applications are approved and what are not.

BF

PUT "LIGHT-BAND" ACCURACY IN YOUR TOOLROOM

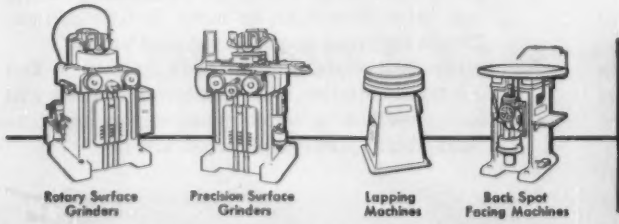
...with a 24" Taft-Peirce Precision Lapping Machine — Only $1,075

Low in cost, economical to operate and maintain, this 24" lapping machine is ideal for high precision work both in the toolroom and in small lot manufacturing departments. Accurate, dependable, convenient, it's capable of producing surfaces flat within 2 to 3 light bands.

The lapping area is a full 24" in diameter. Plates are of close grained cast iron, heat treated and precision ground to ensure permanent flatness. The spindle is roller bearing mounted, and the base construction is of extreme rigidity.

The plates (grooved for flat or plain for cylindrical pieces) are interchangeable in only a few minutes' time. Plain plate is standard . . . machine furnished with grooved plate is $1100.

For more information on this and many other Taft-Peirce toolroom items, send for your copy of the Taft-Peirce Handbook.

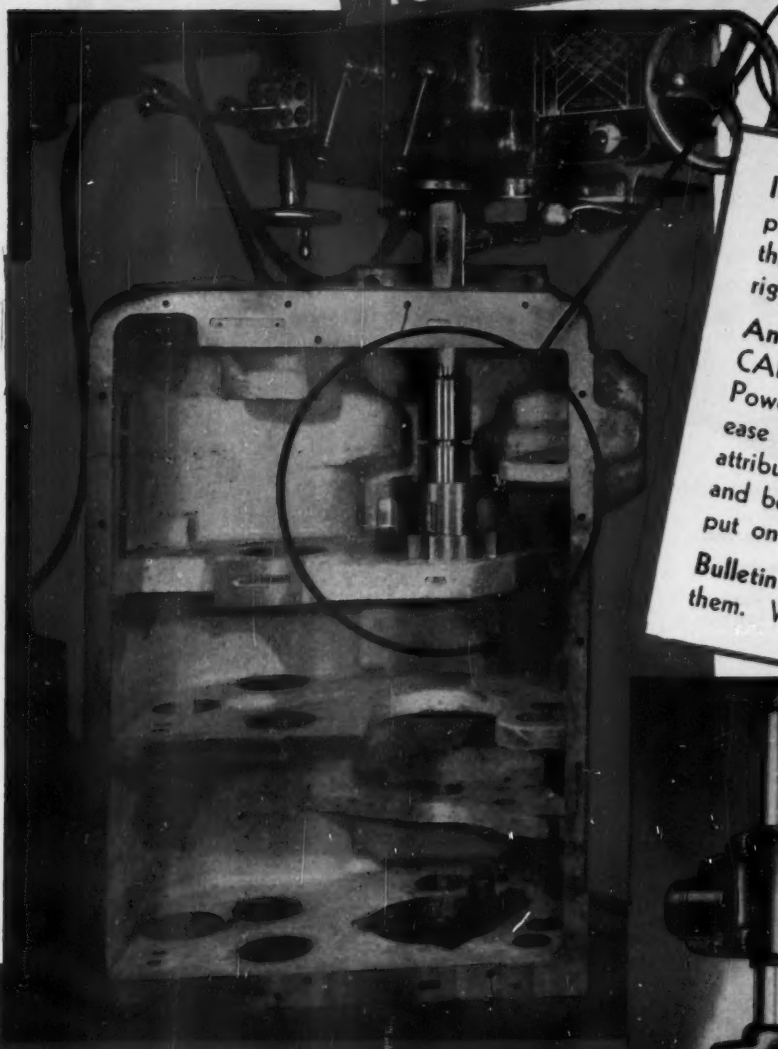


T-P means Top Precision T P

THE TAFT-PEIRCE MANUFACTURING COMPANY, WOONSOCKET, RHODE ISLAND

A GOOD SPINDLE

FOR GOOD BORING AND TAPPING . . .

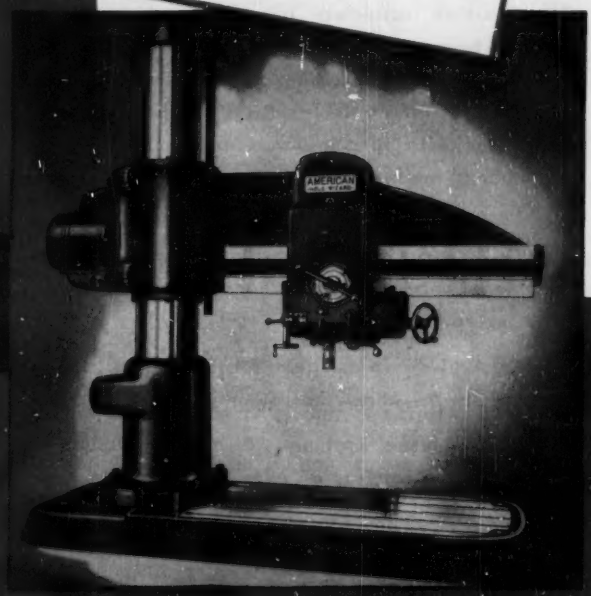


Here's a 10" tapping job on a 5-foot "AMERICAN" Hole Wizard Radial

It takes a sturdy, rigid machine with plenty of power to do work like this. Especially does it require a rigid and smooth-acting spindle.

And that's exactly what "AMERICAN" Hole Wizards are noted for. Power—rigidity—convenience and ease of control are "AMERICAN" attributes that cut drilling, tapping and boring costs wherever they are put on the job.

Bulletin No. 327 tells all about them. Want one?



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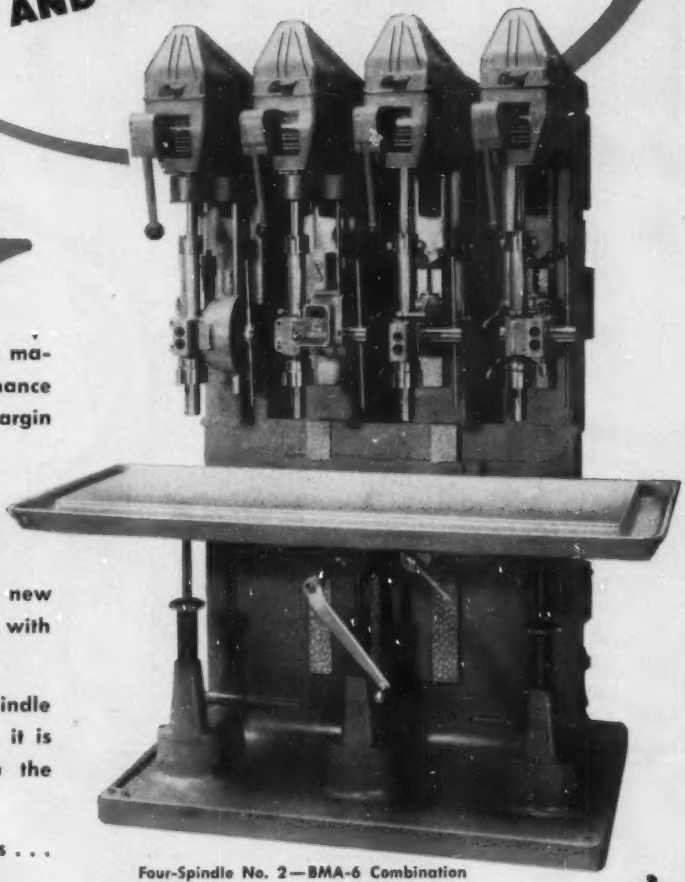
Lathes and Radial Drills

Try an AVEY once . . .

AND YOU'LL NEVER CHANGE



Four-Spindle No. 2—BMA-6 Combination Machine. Built in No. 2 and No. 3 sizes.

You'll be convinced beyond doubt it is the machine you need for uninterrupted performance and increased production with a wider margin of profit.

Our first-time customers become Avey-minded because the Avey High-Speed, Sensitive and Upright Drilling and Tapping Machines do the job faster . . . setting new records for cost cutting and mass production with minimum of maintenance.

You'll be proud to own an Avey Four-Spindle No. 2—BMA-6 Combination Machine . . . it is engineered and time-tested to give you the most for your dollar.

Yes . . . Avey's records speak for themselves . . . and men-in-the-know are listening!

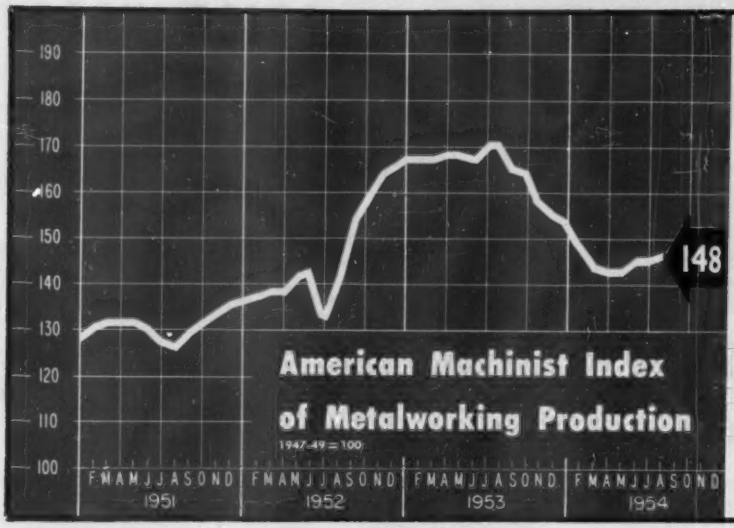
Even your unusual problem will become routine if you use the services of Avey engineering.

Consult the yellow pages in your phone book —under Machine Tools—for our nearest representative, or write direct to our factory.

Avey DRILLING MACHINE CO.

CINCINNATI 1, OHIO

Gaging Metalworking . . .



PRODUCTION INDEX
BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	AUG '54(*)	JULY '54(p)	JUNE '54(r)	JULY '53
Tot. Index...	**148**	**150**	**146**	**171**
Machinery	126	123	145
Electrical Machinery	185	173	200
Autos	95	102	131
Other Transportation	299	284	310
Other Metalworking	126	125	146

(*) Estimated (p) preliminary (r) revised

Metalworking production seems likely to go along through September without much if any change one way or another.

Automotive shutdowns for new model changes have had a dampening effect. The sharp curtailment of car assemblies has been felt in many segments of Metalworking — in parts plants, in stamping shops, in a variety of companies dependent upon Detroit's ups and downs.

Capital goods producers still are going strong, but backlogs continue to shrink and a cut in operations may be in the cards before long.

• • •

Buyers all along the line are cautious. They are paring inventories, but in numerous cases have about reached the point below which they do not care to go.

The aviation industry is one of the strongest props under Metalworking. Despite stretchouts and other devices aimed at spreading out production thinner and longer, production is very close to what it was a year ago.

Aviation parts people, in fact, expect to run at a high level this year and well into next year.

• • •

Commercial stamping plants are operating a single shift 36-38 hours a week. They are looking to the fourth quarter for considerable improvement in orders.

Sweeping style changes in TV set shells and also in new car models will benefit stamping shops.

Production of stampings has been some 25% below last year's. Inquiries are heavy.

Drop forge shops are not doing very well at the moment. Only companies with specialty work possess a good volume of business.

Industrial fastener industry reports an upturn in orders. It is not enough to get excited about, but still is welcome. Outlook is for a steady market for fasteners, with no sharp drops the rest of the year.

Fastener people have been plagued by greatly increased imports of cap screws, nuts and bolts, and by government resale of surplus parts.

• • •

Steel mills don't expect much pickup in releases from customers until the fourth quarter. Current ingot operating rate is 60-65%, with some companies bettering that mark by 5-10 points.

Steel ingot production for the year is being predicted at 90 million tons. Not long ago, that would have been considered a whopping tonnage, and it still is. The trouble is that the industry now has a capacity to turn out 120 million tons.

• • •

Gray iron casters are at 60%. This year they will produce 12 million tons, compared with 13.8 million in 1953.

The booming building and construction industry's orders have taken up the slack that gray iron foundries usually experience in the summer.

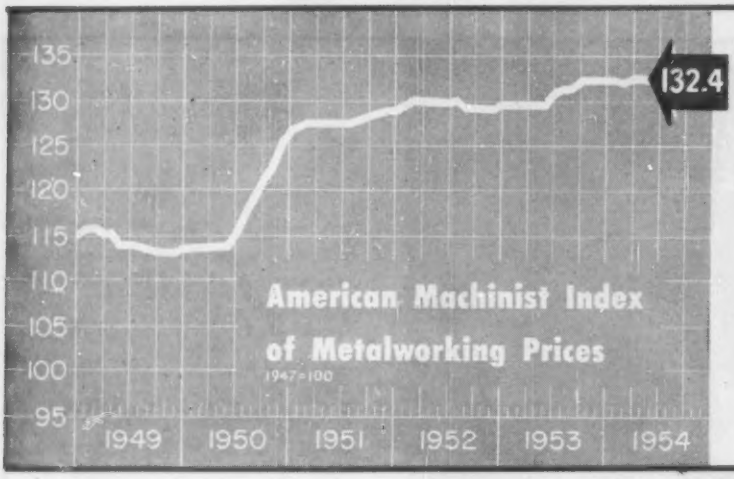
Construction acitivities have been second only to defense work in supporting Metalworking through the third quarter.

• • •

The automobile parts companies are counting on a big push in the final quarter, but few releases for actual production of 1955 parts have come through up to now.

Some parts makers are pulling outside work into their own plants.

Gaging Business . . .



PRICE INDEX

	AUG '54(*)	JULY '54(p)	JUNE '54(r)	JULY '53
Total Index	**132.4**	**132.4**	**132.5**	**131.5**
Metalworking Machinery	**141.6**	**141.6**		**140.8**
Other Machinery exc. Electrical	**137.4**	**137.5**		**135.9**
Electrical Machinery	**131.1**	**131.1**		**129.9**
Fabricated Metal Products	**128.7**	**128.7**		**128.2**

(*) Estimated (p) preliminary (r) revised

Personal buying hit an all-time second-quarter high this year (previous high: 1953).

Buying increases occured in all areas — durable and non-durable goods and services.

July retail sales were $14.3 billion — only 1% below the June figure. Looks like the consumer is spending more, saving less.

• • •

Second quarter business investment was $1 billion ahead of first quarter's $44.5 billion, but $10 billion under second quarter 1953.

High residential construction expenditures were responsible for the second quarter upswing.

• • •

Inventories made the big difference over the year, however — they are currently being liquidated at an annual rate of around $4 billion, compared with 1953's $5 billion.

June manufacturers' backlogs stood at $73.6 billion. This means about $25 million back orders have been worked off by manufacturers in less than a year.

US Gross National Product (total output of US goods and services) ran at an annual rate of $356 billion in the second quarter. This was $200 million higher than the first quarter, but nearly $14 billion under the peak quarter of 1953.

Gross National Product is currently running about $1 billion ahead of the second quarter.

• • •

McGraw-Hill's Index of New Orders for Machinery (except electrical) for July shows a slight drop off. Seasonally adjusted July Index was at 91 (1950 = 100), compared with 94 for June, and 97 for July 1953.

• • •

If new orders continue to hold up in August, it could mean that machinery manufacturers can look forward to a brighter situation than they faced only two months ago.

At that time, machinery makers were beginning to wonder how they could keep operating at then-current output levels.

WEEKLY BUSINESS INDICATORS

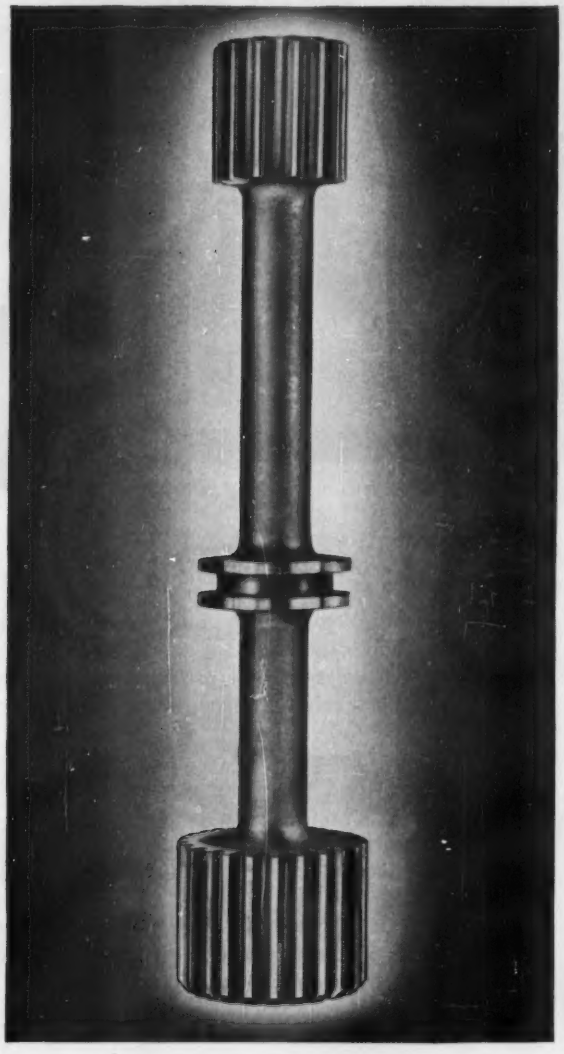
	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-1949 = 100)*	123.6	124.2	136.0
Steel ingot operation (thousands of tons)	1,481	1,525	2,162
Electric power output (million Kilowatt hours)	8,996	9,059	8,514
Production of automobiles and trucks	118,604	124,168	156,526
Engineering construction awards (*Eng. News-Record*—millions)	$258.9	$419.2	$259.0

MONTHLY BUSINESS INDICATORS

	Latest Month	Preceding Month	Year Ago
Index of industrial production (1947-1949 = 100)*	124	124	127
Index of durable manufactures production (1947-1949 = 100)*	136	135	157
Durable goods manufacturers' sales, millions*	11,318	11,344	13,166
Electrical machinery manufacturers' sales, millions*	1,309	1,291	1,486
Other machinery manufacturers' sales, millions*	1,860	1,862	2,164
Durable goods manufacturers' new orders, millions	9,965	10,050	12,392
Electrical machinery manufacturers' new orders, millions	865	1,000	1,303
General machinery manufacturers' new orders, millions	1,745	1,657	2,084

* Seasonally adjusted

RESISTS FATIGUE 3 TIMES AS LONG AS RUNNER-UP IN TEST



Here's a case where Armco 17-4 PH Stainless Steel solved a fatigue problem in a vital hydraulic pump shaft for military aircraft use. Under accelerated fatigue tests the shaft made of Armco 17-4 PH lasted 30 hours. The next best metal in the identical test was a non-ferrous alloy. It lasted nine hours. Shafts of 4140 alloy steel and Type 440-C stainless steel lasted less than one hour.

Many other metals were tried but it took a special stainless steel, Armco 17-4 PH, to meet the mechanical requirements of rapidly changing loads, fast acceleration and deceleration.

WHAT ARMCO 17-4 PH OFFERS

Armco 17-4 PH is a precipitation-hardening stainless steel of good corrosion resistance. It can be fully hardened after fabrication by holding at 850 to 900 degrees F for 1 hour and air cooling.

Because of the low-hardening temperatures, Armco 17-4 PH can be finish-machined in the annealed condition without allowance for scaling or distortion in heat treatment. Machining speeds are the same as for Type 410 (BHN 280-320), while in the hardened condition, Armco 17-4 PH can be machined at 60 per cent of Type 410 speeds. In both cases, finish is excellent.

WRITE FOR INFORMATION

Armco 17-4 PH is produced in billets, bars and wire. Then too, there is the double heat-treatment precipitation-hardening grade known as Armco 17-7 PH. It is supplied in sheets, strip, plates, bars and wire. Write us for complete information on both of these grades.

ARMCO STEEL CORPORATION

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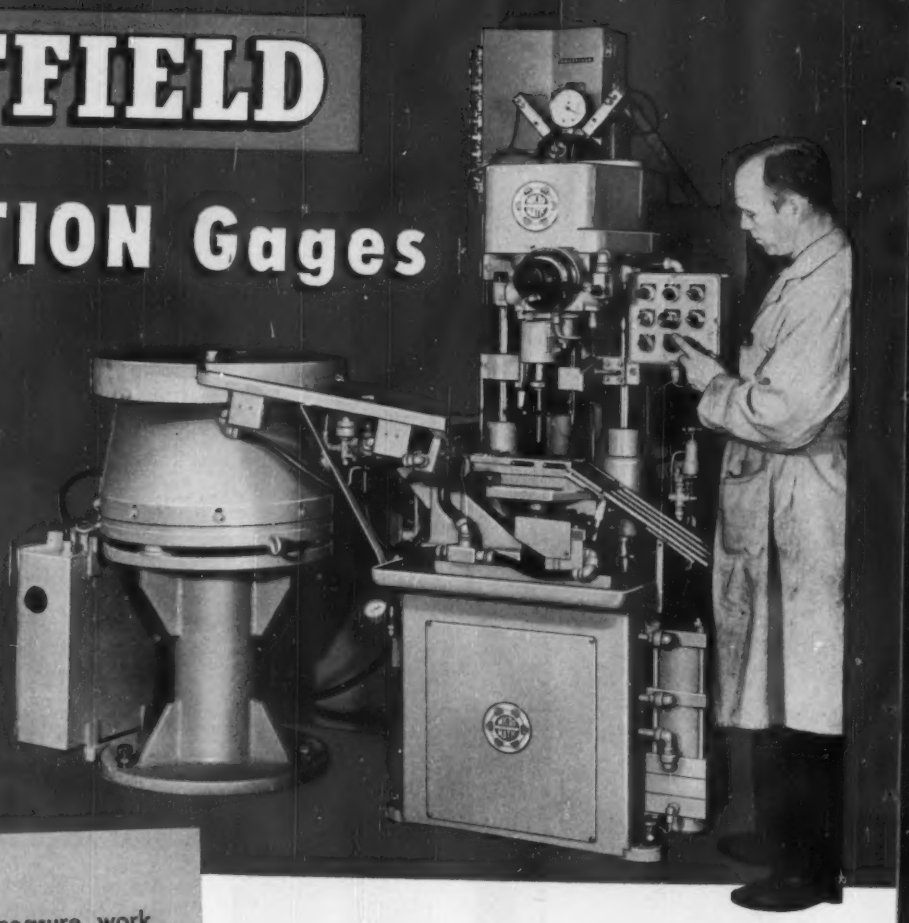
SHEFFIELD

AUTOMATION Gages

Assure Fast Accurate Machining

Sheffield Automation Gages are package units, ready-to-use and economically priced, for the control of grinding, boring, drilling, honing, milling and turning operations.



Mounted on machine tools, they measure work part dimensions and space relationships and instantly translate this information into electrical impulses which in turn:

- **Energize signal lights**
- **Actuate solenoid ejection or classification mechanisms**
- **Start and stop the machine tool**
- **Provide feed-back control**
- **Control cutting tool or grinding wheel positioning and compensation, also time cycle.**

A Typical Application

Here the bore of transmission pinions is being honed and gaged automatically.

If the actual bore size, after honing, is within .0001" of either tolerance limit, white warning lights flash on.

If either tolerance is exceeded, a red or green signal flashes and the faulty part is automatically ejected.

When a predetermined number of rejects pass through in succession the machine is automatically stopped.

The actual size of each bore, as it is gaged can be read on a conveniently located air gage dial as built into the machine tool pneumatic circuit.

The Sheffield Corporation, Dayton 1, Ohio, U.S.A.

MASTER CRAFTSMAN SHEFFIELD HEADQUARTERS

SHEFFIELD

Sheffield AUTOMATION ENGINEERS will gladly consult with you about automatizing your production.

6891

American Machinist

MAGAZINE OF METALWORKING PRODUCTION ★ ESTABLISHED 1877

No Raids on Machine Tool Reserves!

No government policy is likely to stay static long. It is subject to constant pressure to change because special interests are served by so doing.

These comments are prompted by the situation now arising about government-owned machine tools.

A sensible and practical policy was established last year by the director of defense mobilization. It specified that machine tools no longer used in defense production were to be retained by the "services," mostly in production packages.

These machines were not to be leased to private industry for use on civilian work but were to be kept intact to be drawn upon in an emergency.

The armed services might apply in an emergency for exceptions to this rule. If they did, ODM was to consult the Business and Defense Services Administration of the Department of Commerce.

The defense mobilization director has reaffirmed this policy on more than one public occasion. Despite these reassurances, the policy seems to have teetered on the brink at times, with a good prospect that it might topple over.

Once again we detect a tendency of the policy to totter. Certain Army officers would love to give the policy a shove and drop it into oblivion.

They are viewing the situation solely from the angle of their own budget convenience. Dollars and cents instead of national security prevail.

They are proposing that production packages, in whole or in part, be leased to manufacturers who are their custodians. The Army thus would be spared the expense of storage.

This is just what the doctor ordered if you are thinking in terms of a sharp pencil. If, however, you are concerned, as you should be, with the nation's mobilization needs, you quickly perceive the peril in such a leasing policy.

It is a policy of scatteration. If it is adopted, it will be the first step toward breaking up production packages, despite the Army's disclaimer of any such intent. The next step is likely to be to lease machines to anyone who wishes to use them. Such scatteration would make it a tedious and painful process to reassemble the machines comprising production packages in an emergency. More than that, the time involved might be fatal to our national security.

It is a policy of discrimination. It enables a manufacturer to lease from the government at an absurdly low rental a machine that he requires. Otherwise he would be compelled to invest his own capital in a new or used machine, or rent a machine from private industry at a much higher monthly rate.

The taxpayers, in other words, would be helping to subsidize one company which has leased US-owned machine tools at the expense of a competitor who has spent his own money to equip his plant.

Wholesale leasing of services-owned machines is undesirable and dangerous, from whatever angle you look at it. What the Army would like to do now is to have the control of leasing taken away from ODM and put in its own hands. That action should not be sanctioned by the White House, Pentagon, or ODM itself.

To the credit of the Defense Department, as differentiated from the Army, it is reported to be against the proposal. It favors maintenance of the status quo. We do too.

The only sensible policy is to keep our production packages and national reserves of machine tools inviolate and not subject to raids. These machines are too critical to our future mobilization needs to be subject to commercialism.

Burnham Finney

72 HOLES

Photos courtesy Kirt & Blum, Cincinnati, Ohio

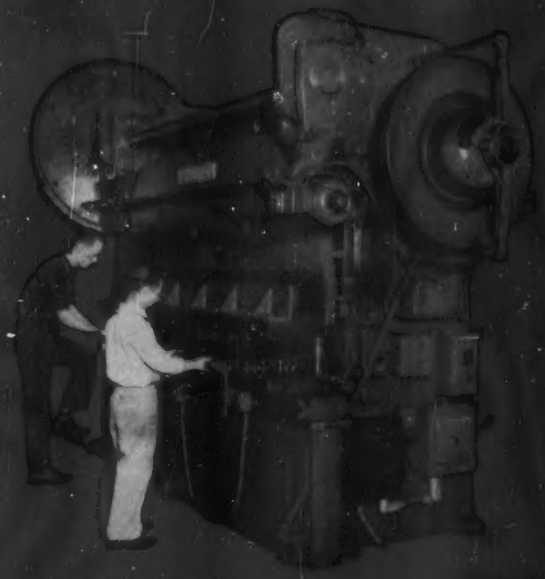
where they belong

Economical assembly depended on maintaining the accurate spacing of these 72 holes and their accurate positioning on this 10-gauge sheet.

This Cincinnati Press Brake is giving a high production at low cost by its speed and accuracy of performance, which insures rapid low cost assembly.

As a press, they offer high production with low investment. As a Press Brake, their low set-up costs, quick change-overs and versatility bring profits.

Write for Catalog B-4 where many examples of the versatility of Cincinnati Press Brakes are illustrated.



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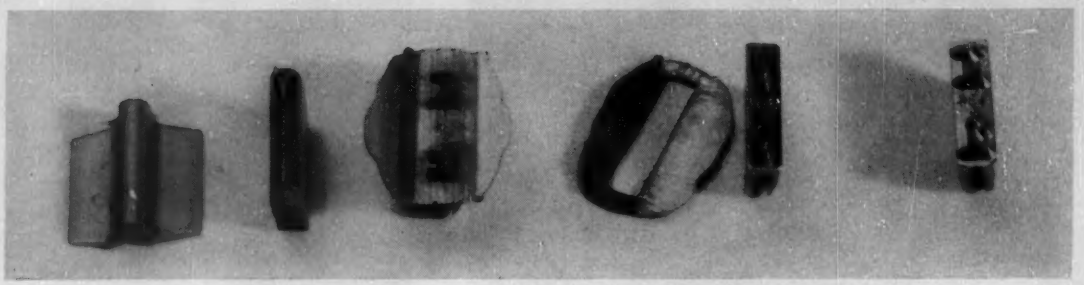


TYPEWRITER-TYPE SEGMENTS ARE MADE LIKE THIS . . .

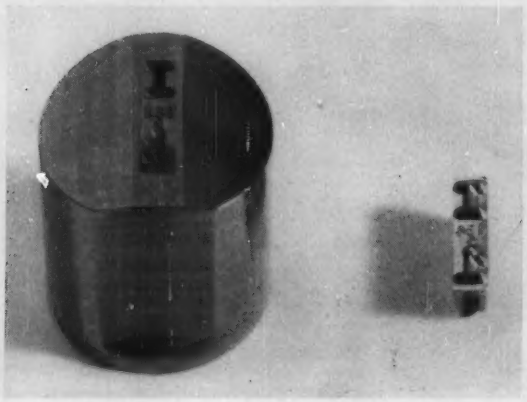
Type is produced from contour-rolled strips of a case-hardening steel (basically 1020), obtained from Newman-Crosby or Crucible Steel. Here is the sequence of operations: First, the strip is blanked, next the fins are folded down (both in automatic presses), blanks are washed and pickled to remove scale, the characters are "kneaded" in the face, flash is trimmed off, pieces are washed, dried, cyanided to 0.003-in. case, washed and dried again, flash nickel-plated (0.0002 to 0.0003 in.), and they are ready for assembly. Tolerances are 0.0015 to 0.002 in. on type shape and position. Each piece of type carries tiny raised letters between the characters for identification (there are some 55,000 current die designs, including specials), so these must also appear in the die. This photo shows type about double size

Work cuts tool, tool forms work .....with ultrasonics

E J TANGERMAN, executive editor

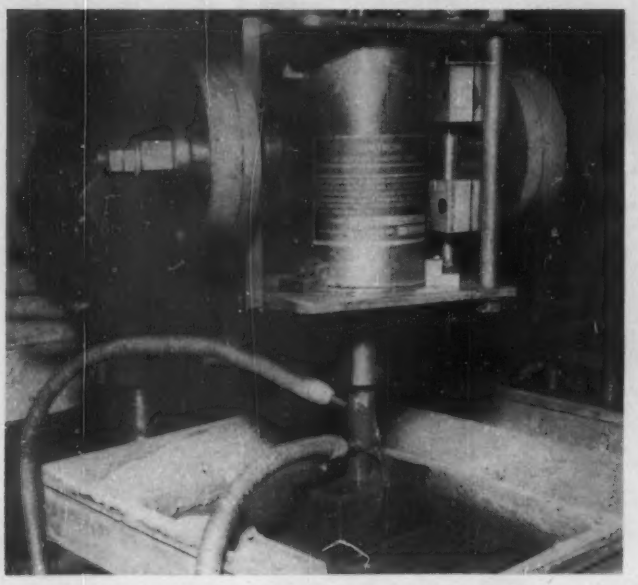
Carbide "kneading" dies for adding machine and typewriter type are made with the type itself; glass matrix plates replace metal; header and type dies last many times as long—that's the record of the first year since Remington-Rand put an ultransonic unit in the toolroom at Elmira, N Y

DIES CAN BE MADE BY ULTRASONICS . . .

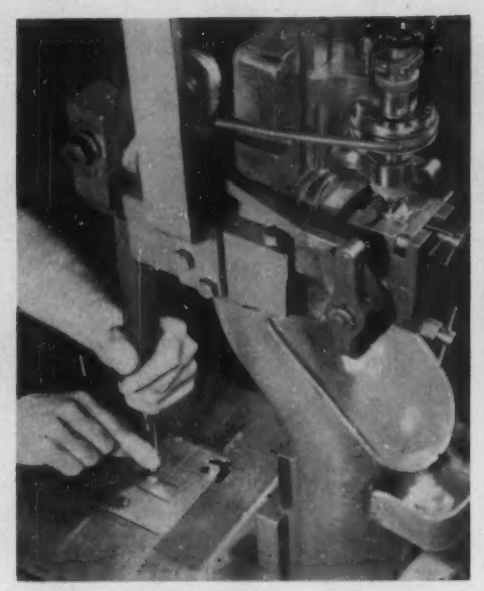


Type-rolling or "kneading" dies like this (2x) were formerly of hardened steel, produced 2000 to 3000 pieces of type before they wore out. Now dies are produced by ultrasonics from CA 20 or K 90 carbide blanks, using pieces of type as the tools. The first set of 13 dies for adding-machine characters (0 to 9, plus S, V and *) have produced something like 20 times as many pieces, in the last 16 months, are still in service. Formerly 2567 steel dies were used per year, at a cost of $6 per die for die-maintenance labor, to produce about 5½ million pieces of type. Carbide dies produced this number of pieces for only $300 in labor last year. One die has produced 99,822 pieces to June 1, another over 112,000 to date. Both are still in use. A second or "backup" set of carbide dies, made a year ago, has not yet been used. When dies wear, 0.005 to 0.010 in. is ground off, a HSS shim silver-soldered on, and the die surface recut. Blanks are 0.0750 x 0.890 in. long, are ground to 0.875 in. long, plus or minus 0.001, are finished by grinding the flat on one side and the clearance chamfers on each side of the characters

(NEXT PAGE, PLEASE)



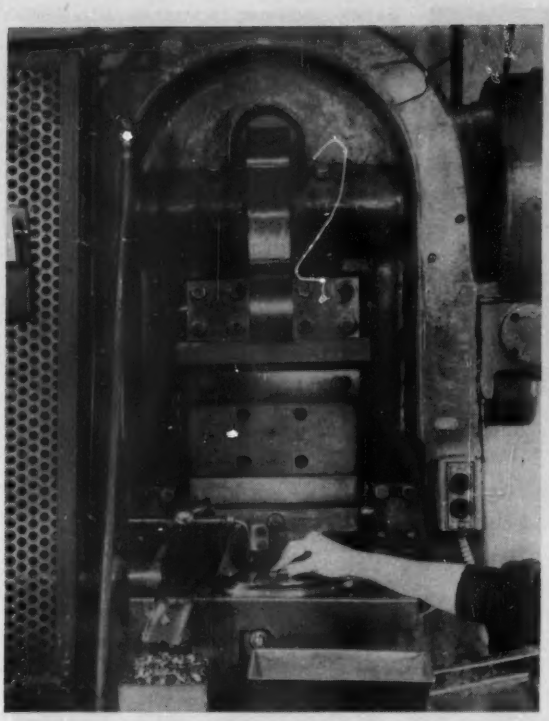
THE SHEFFIELD CAVITRON MACHINE, Pioneer Model 500 C (sliding-swinging-arm type), has two tables. Toolholders have twin parallel slots into which a piece of type is slipped and gripped by side setscrews. The tools are just production pieces of type. Brass type could be used and probably would last longer, but steel is available and inexpensive, so three to five pieces are used in making each die, then discarded. Dies are roughed on the left table to about 0.020-in. depth (within 0.005 of finished size) with boron carbide (Norbide) of 250 grit, then transferred to the right table for finishing with 600-grit Norbide. Time per die is about 7 min, of which actual cutting time is 96 sec. This includes changes of type, cleaning and checking as cutting proceeds. The machine is in a formerly vacant die vault that can be locked; otherwise a tool capable of cutting anything would be in considerable demand for toolmakers' personal jobs. Tool head is counterweighted for balance



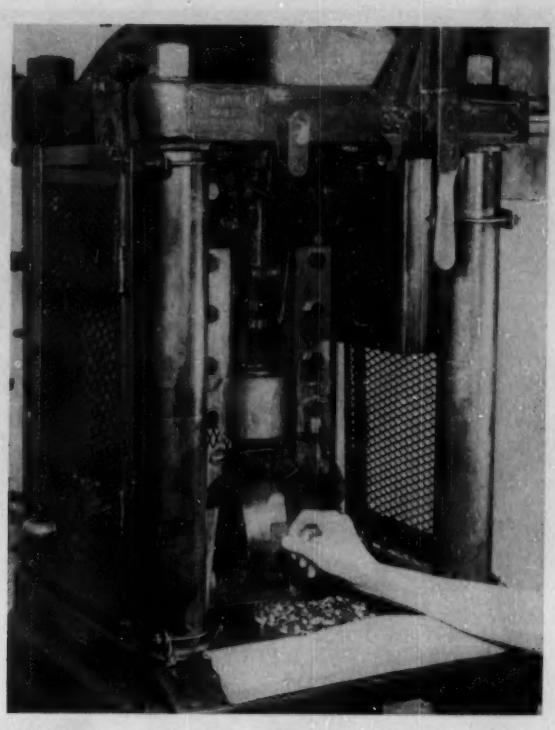
NEW OR SPECIAL CHARACTERS require the former process to be used. This involves having the designer produce a master drawing 50 times finished size on Bristol board. This is reduced to 20 diameters onto a steel plate master on a Gorton engraver. The master is in turn set on a Remington-built engraver (shown), where the original steel die is cut. Here the templet is at lower left, the die in process at upper right. Now, master dies will produce only a few pieces of type (unless they are very special), to serve as tools in producing carbide dies. Current experiments center around replacement of the steel master with a photo-engraved Photoceram glass plate—eliminating the first engraving step. This is a special photo-sensitive glass made by Corning on which images may be photographed, then etched. The glass is ultimately heat-treated so it is practically unbreakable

TYPE SEGMENTS ARE "KNEADED" FROM STRIP ...

TO MAKE TYPE SEGMENTS, specially rolled strip is first blanked (see headpiece photo), then blanks are deposited in the Syntron vibrator shown here. It feeds blanks, "head" down, into two inclinable crankpresses tooled to operate automatically. Both presses do the same operation, folding the "ears" of the blank up parallel to each other to produce the surfaces later silver-soldered to type bars. The automatic feeder is a recent addition, halves the labor on this operation and reduces danger. The operator need only make sampling inspections and keep the hopper filled



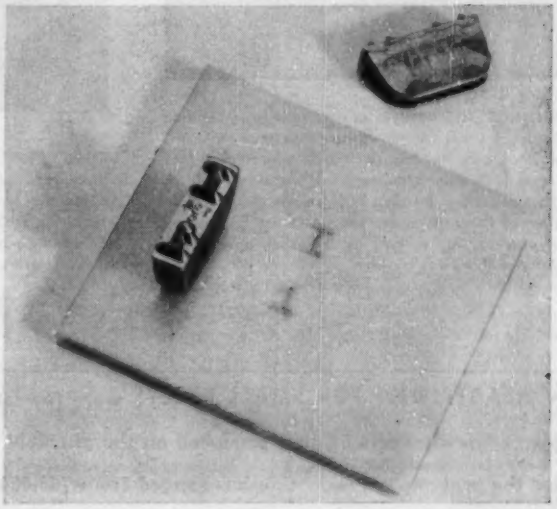
CHARACTERS ARE "KNEADED" into type heads in these rocking-head presses made by Pratt & Whitney some years ago. The blank, fins down, is set on a saddle in a dial feed, which carries it under the ram carrying the die. Rocking action of the ram forces the die into the head, kneading excess steel to the edges as a flash. Half a dozen rockings produce the type, which is ejected into the box at left. Operator merely loads the dial; type is produced at 1200 pieces per hour automatically, clean, sharp, and requiring no finishing



KNEADED BLANKS are set into sockets on the drums of presses like these (also made by Pratt & Whitney), for trimming off flash. Again the operator merely loads; press operation is continuous. Flash is ejected through a tube into one container, trimmed type into another. This is basically a crank press, although of special shape. Trimming is to close tolerances, so no further trimming is required. Type is washed and dried, cyanided to 0.003-in. case, washed and dried again, then flash nickel-plated (0.0002 to 0.0003 in.) and is ready for assembly

GLASS MATRIX PLATES SOLVE SEVERAL PROBLEMS...

AN INTERESTING SECOND USE for the ultrasonic cutting process developed in soldering type to striker bars. Type segments are assembled to striker bars after the latter are assembled to the head frame. Essentially, the head frame stands vertically, and type bars are brought down in turn to set into the proper type segment. To locate the type segment (and thus to assure alignment of characters in striking position), small steel matrix plates were used, one with female impressions for each character. However, operators occasionally got on too much solder (which joined plate and segment), and plates developed residual magnetism (from a magnet beneath) so segments stuck to them. Monel was substituted, but proved little better (a trace of iron in it also resulted in residual magnetism!) Also, operators occasionally staked or filed plates "to make them fit the fixture better." So Photoceram was substituted, and ends all these troubles. The glass is photographed with a grid and etched to exact size (including locating radius) 90 squares at a time from big sheets and fired afterward for hardness and toughness. Tolerances are within 0.001 in. Characters are then cut by Sheffield Cavitron just as dies are made, except that the process is much faster. To see matrix plates in use, turn the page



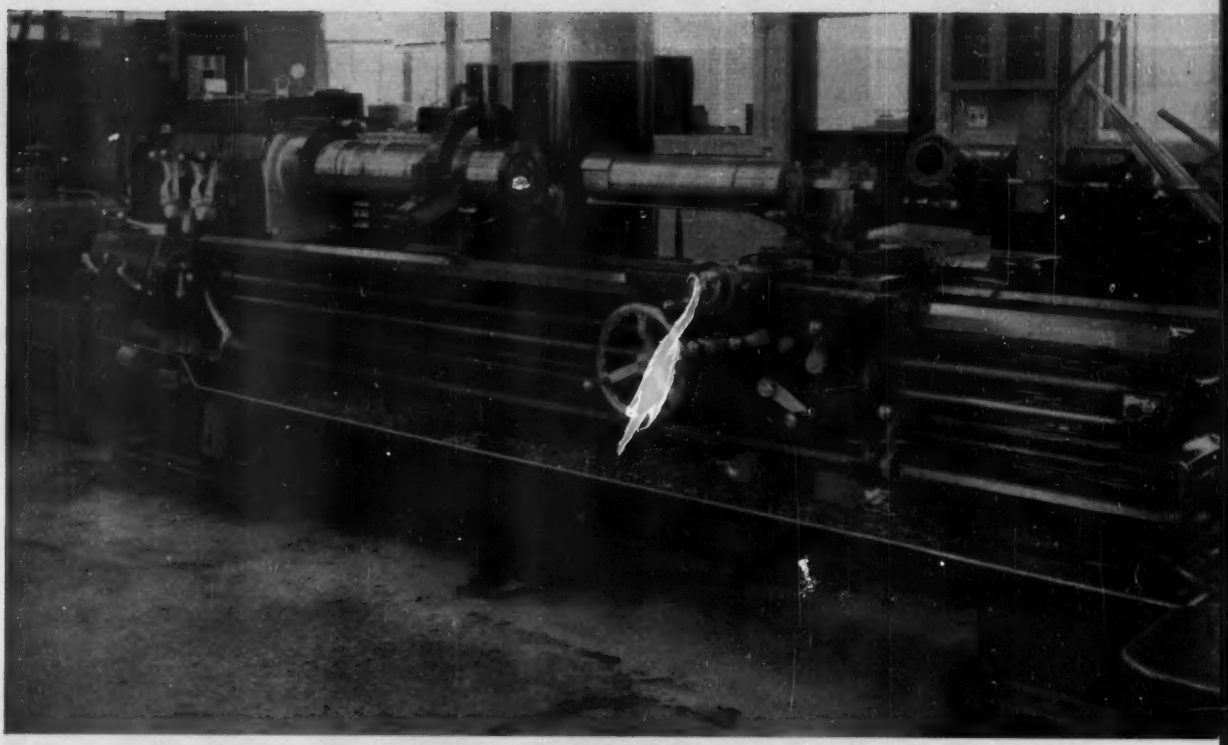
MATRIX SOLDERING PLATES for a particular keyboard are stored on edge in wooden racks like that at left; type characters in boxes to match (lower center). The operator takes a matrix plate, snaps it into a fixture on this rotary-table soldering machine. It will go in only one way, because the radiused corner must clear a spring. With her other hand, she places a type segment on the plate. It snaps into the impression because of a small Alnico magnet beneath the plate, is held exactly in position so the striker bar can be brought down into it and held by the same magnet. The table indexes counterclockwise to the next station, where an arm carrying a brush deposits acid flux in the joint. At the next index, the assembly is heated by bracketing gas flames which lower around it, and exactly the correct amount of silver solder fed in to make the joint so the operator can lift the assembly, replace the plate with the next and continue. This machine, a recent development, produces 68 joints per hour, as compared with 42 with the former twin-station manual setup, is less fatiguing and exacting, and gives more-uniform joints

AND SO TO FINAL TEST . . .

FINISHED ASSEMBLIES are tested in a unique Bausch & Lomb "Shadowgraph" (contour projector) which shows the top (left) side (right) and face (center) of each type segment simultaneously as the striker bar carrying it is raised into position. Thus all three alignment tolerances can be checked at once as well as type clarity. Each assembly is checked thus, bar by bar

ROBOT INSPECTION has been applied to adding machines to save $100,000 a year. Standard "Robot-Typer" units, operated by a punched-tape "piano roll" like an automatic typewriter, are adapted to operate appropriate keys for a series of problems which test all operations of the machine. The standard test takes 15 to 17 minutes, permits one operator to test five machines at once and eliminates the human errors which once made frequent retesting necessary

• **HEADER DIES FOR SMALL RIVETS** were formerly of case-hardened steel, lasted for 50,000 to 150,000 pieces. Several sets of dies, produced on the Sheffield Cavitron machine of CA 20 carbide, have been in use for the past year. Production has ranged from 750,000 to a million pieces per set.



Trepanning setup... at Watertown Arsenal. Titanium billet chucked in the lathe cost $4725. Trepanning 6-in. hole permitted salvage of a core worth $1455, took 5½ hr. Shielding to catch oil and chips has been removed

Trepanning titanium

saves time and material

Large cylinders of titanium alloy can be produced by trepanning from solid billets, salvaging the core from the hole by substituting rollers for wear plates and changing the method of oil supply

S E SIEMEN, chief, NICHOLAS ROSATO, assistant,
laboratory machine shop, WATERTOWN ARSENAL, WATERTOWN, MASS

Trepanning—the method of cutting holes as an annular groove with a solid core—has had rather limited, though increasing, application, but seems likely to become much more important in cutting titanium alloys. Here the high cost of the material makes the saving of the core important. Time is saved by reducing the volume of metal to be removed.

Watertown Arsenal had need of some titanium cylinders about 35½ in. long with ID about 6 in. Metal removed by drilling and boring the ID would have cost $2539 in solid form and be worth only $169 as chips for a net loss of $2366 per cylinder.

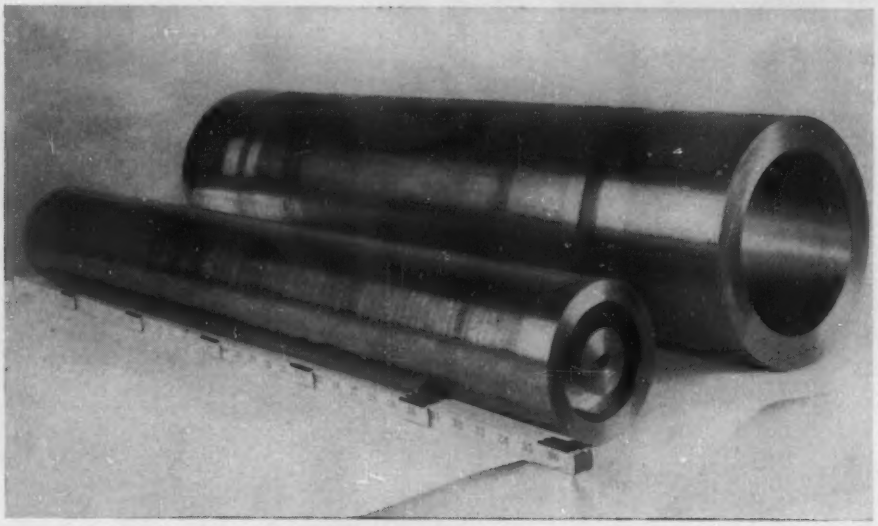
Extrusion of the section was rejected because of tooling cost and scheduling delay.

Trepanning the hole required 5½ hr per cylinder and produced a core worth $1455. The chip loss was $1085 worth of titanium alloy converted to chips worth $72 (a net material loss of $1013 compared with $2366 for drilling).

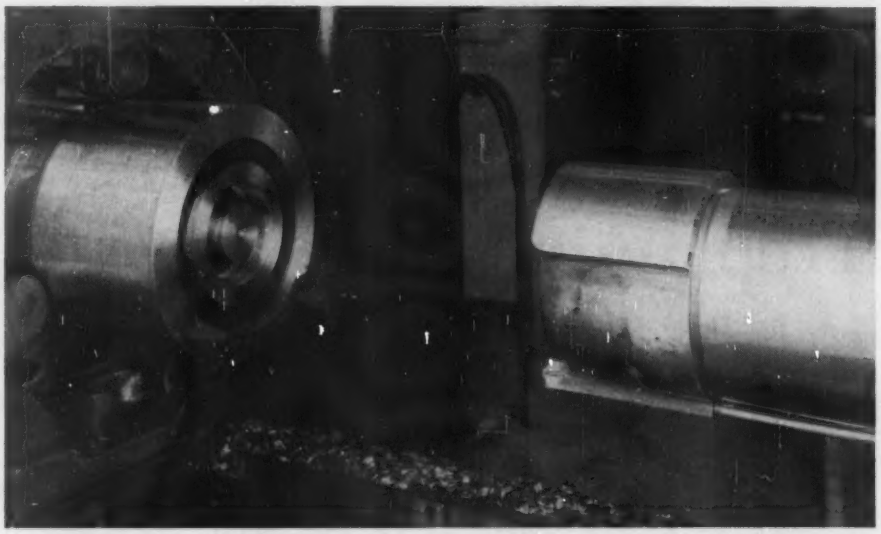
The operation was performed in a conventional Monarch lathe with 8-ft bed and 7-hp motor. The tailstock was removed and the carriage modified to hold the pipe supporting the trepanning head.

This head is basically of conventional design. We

PLEASE TURN PAGE→



Completed cylinder... with approximately 6-in. ID and 4¼-in. core. Smaller cut in end of core was caused by a short test run with smaller cutter



Cutter is three-section design... with high-pressure cutting oil feeding out through the groove cut in center. Chips are well broken up, easily flushed out through the recessed section of cutter head

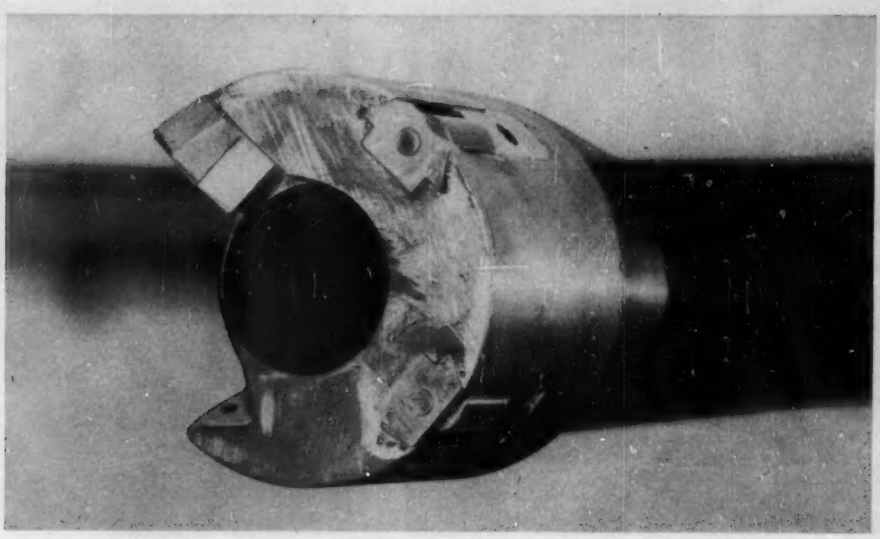
found it necessary to replace the wear plates with rollers. Both carbide and bronze wear plates on the cutting head proved unsatisfactory in test because of severe galling.

Rollers 1 in. long and 0.514 dia are AISI 1095 steel drill rod, hardened and tempered to 55 R_c. The rollers turn on pins made of the same material and supported in plates dovetailed into the head. These plates are case-hardened AISI 1020 steel.

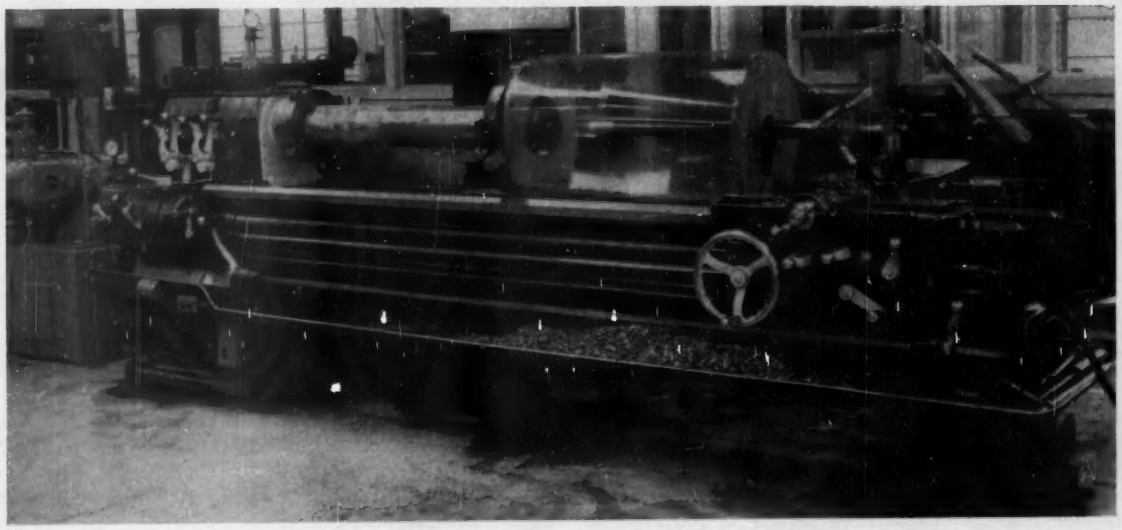
The trepanning cutter is a high-speed steel planer tool ground to the Bethlehem three-point design (*AM*—Jan 4, '54, p 99) that produces small, broken-up chips easy to flush out.

Cutting oil is supplied through a 1/16-in. ID high-pressure tube to a groove cut in the face of the cutter that directs the oil along the cutting edges of the tool. This modification, combined with clearance space on the *outside* of the head, eliminates the need for an oil seal. Oil pressure at the tool is constant regardless of the depth of the hole.

It is also necessary to supply oil to the rollers by bleeding off the main line to the roller pins. To



Reverse side of cutter... head shows method of mounting rollers and the addition of oil jet on opposite side of clearance recess, facing the cutter



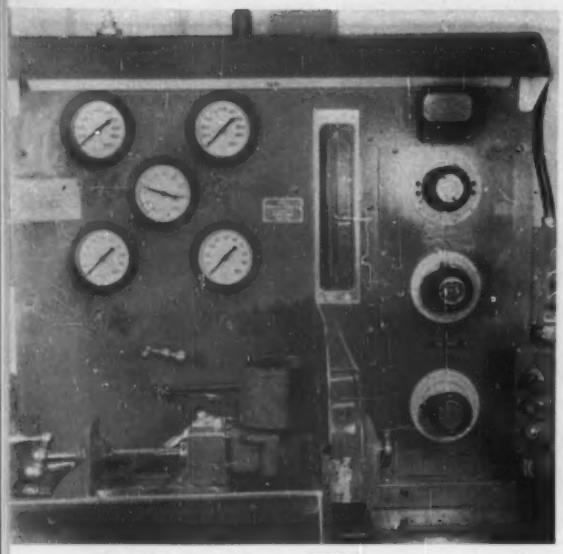
Sliding transparent housing... over open end of work catches oil and chips ejected from the hole

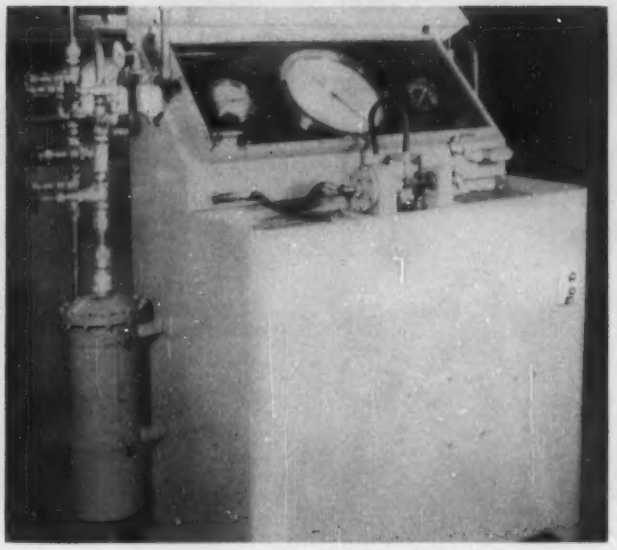
prevent chips from working in ahead of the trepanning head, it was found desirable to have a second oil outlet at the opposite side of the clearance space in the head. This applies a jet of oil against the bottom of the hole ahead of the cutter. Chips are driven away from the bottom of the hole and back through the clearance along the outside of the trepanning head.

Oil is supplied by a high-pressure pump capable of 20 gpm at 5000 psi. Initially a pressure of 1500 psi was used, but this has been increased to 2500 psi with 12 gpm. No refrigeration of the cutting oil is needed.

Initial cuts were made at 23 rpm with a feed of 0.006 ipr. Speed was later increased to 37 rpm, with feed still 0.006 ipr.

The titanium alloys cut in these operations were Mallory-Sharon (MST 3 Al-5 Cr and MST 6 Al-4 V). The completed bore showed feed marks on the inside, but was round and straight within 0.0005 in. for the 35½-in. length. The diameter of the core varied less than 0.001 in. from one end to the other.





TESTING PUMPS and VALVES for power steering units is accomplished on individual test stands (for pumps, at left and valves at right). Parts are delivered through ceiling of inclosures by means of a power and free conveyor system and removed the same way. Test standards exceed performance required in actual vehicle operation to insure high-quality performance

Oil for power steering tests purified

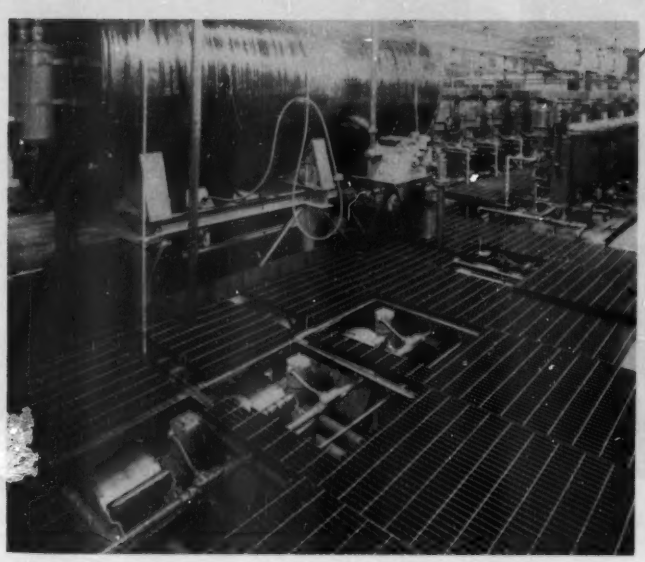
Hydraulic oil employed in testing pumps and valves for power steering units at Saginaw Steering Gear Division of GMC must be kept clean and, for reasons of economy, re-used. This is accomplished by a unique system of centrifuges, separators, and temperature controls that permit constant recirculation of clean oil to test stands. Features of the installation are described here

Power steering units are made on a high-volume basis at Saginaw Steering Gear Division of GMC for General Motors cars as well as for those of several independent manufacturers and a number of tractor makers. Exhaustive testing is required to insure high-quality performance in actual use and this end of the processing is as efficient and streamlined as the production phase. A secondary advantage of testing the units is that minute particles of foreign matter are flushed from them during the process by the flow of clean, filtered oil.

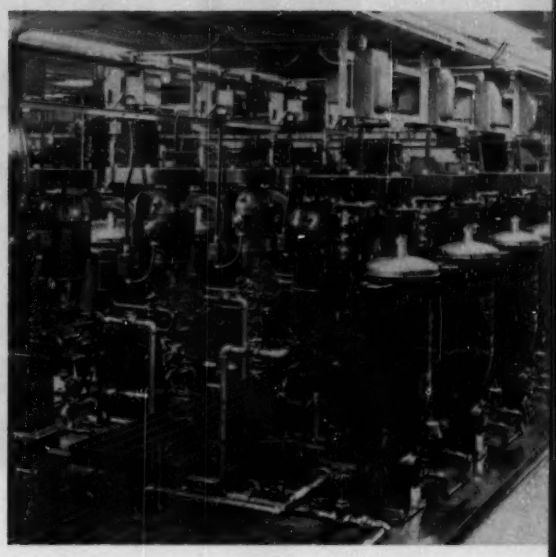
Essential components of the power steering units are a positive-displacement pump and a reaction-plunger-type directional control valve machined to extremely close tolerances. The pumps and valves are tested immediately after final assembly. Oil is delivered at 90 psi and high volume to 19 test stands for this work. Volume is maintained at 100 gpm while pressure is reduced to as near zero as possible to avoid supercharging the pumps on test. Actually, a range of one to five psi is permissible. Particle size of clean oil delivered to the stands is held to five microns. A typical function test on a pump would require this performance:

1. Minimum output 1.0 gpm at 465 rpm against 700-psi pressure.
2. Maximum output 1.9 gpm at 2,000 rpm against 50-psi pressure.
3. Relief valve to remain closed against 750-psi min to 900-psi max pressure.
4. Pressure at any speed not to exceed 900 psi.

Each test involves the recirculating of oil through the pump or valve during which the fluid picks up minute quantities of dirt, metallic particles, moisture and other contaminants. Oil from the test stands is returned to a 2,000-gal. capacity "dirty-oil" tank located below the floor level. Installed in piping ahead of this tank are Barnesdril magnetic separators which remove the heaviest ferrous and non-ferrous particles from the oil, thereby relieving some of the load from a bank of ten Sharples centrifuges which pump the oil from the dirty-oil tank.



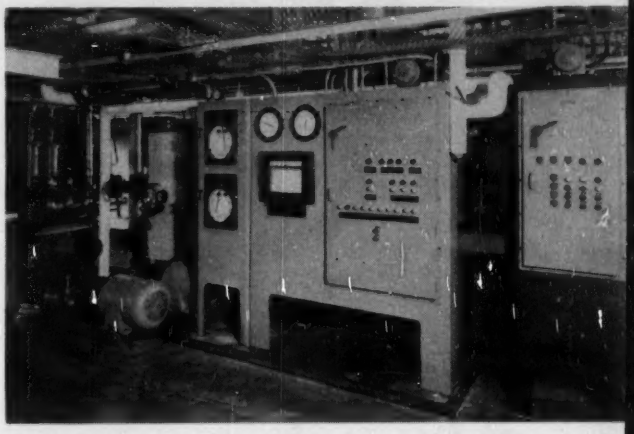
DIRTY OIL from test stands is carried to underfloor tank where Barnesdril magnetic separators remove heaviest particles which fall into sludge pan. Centrifuges in background receive oil from this tank, purify it and deliver it to large tank visible above floor level



OIL IS CLEANED within 5-micron particle size by means of ten Sharples centrifuges. Constant circulation of oil through centrifuges, whether test stands are in operation or not, provides high degree of purification. Waste oil and water are discharged to a decanter tank from which a certain amount is returned to one centrifuge for reprocessing. Purified oil is delivered to clean oil tank for transmission back to test stands

and re-used

J A HUDSON, supervisor of process development
SAGINAW STEERING GEAR DIV. GENERAL MOTORS CORP

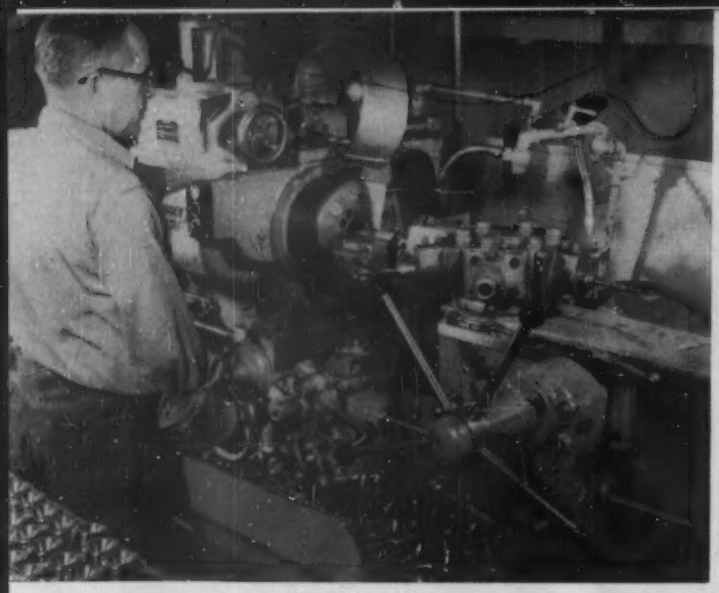


OIL TEMPERATURE IS MAINTAINED at control panel to insure viscosity of 66 ssu at 88 F, at test stands. Oil leaving clean tank passes through heat exchangers, is mixed and then passes a resistance thermometer bulb that controls temperature. Roper constant-displacement rotary pump runs continuously while system is in operation, provides 100 gpm at 100-psi pressure

The centrifuges are arranged in two groups of five each and one line from each group feeds purified oil to a clean-oil tank where it is stored for settling to eliminate air. Heavy liquid and water are discharged to a decanter tank from which a certain amount is drawn off again to one centrifuge in the group for re-purification.

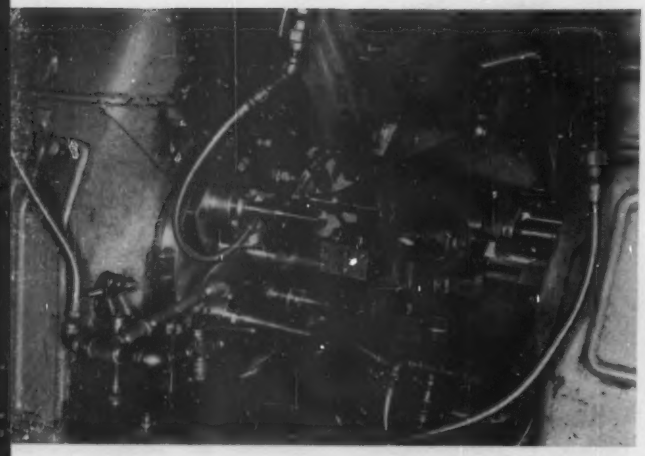
The clean-oil tank has an overflow that empties back into the dirty-oil tank below the floor and there is enough oil in the system to permit continuous overflow. Centrifuge capacity was established to permit purifying the maximum flow of oil going to the test stands. Therefore, if some of the test stands are not operating, clean oil overflows to the dirty-oil tank for recirculation. Continuous recirculation in this manner insures a high degree of purification.

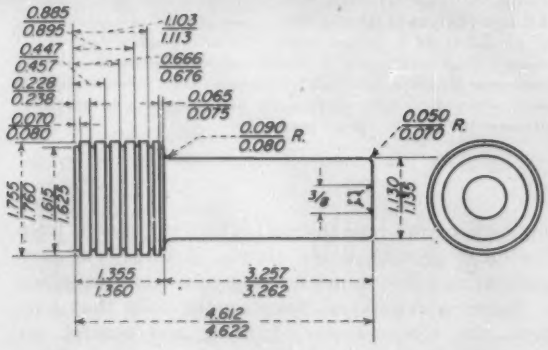
Maintaining proper viscosity of the oil, 66 ssu at 88 F is important to insure accurate test results. Therefore heat exchangers and temperature controls are incorporated into the system. Two heat exchanger coils, one for heating and one for cooling, are in the line through which oil passes from the clean oil tank to test stands. A three-way proportioning valve mixes hot and cold oil, after which it passes a resistance thermometer bulb that controls the temperature-indicating and control instrument. Each pump test stand is provided with a control panel by means of which speed is accurately controlled. Pressure reducers at each stand cut 100-psi oil pressure down to 1 or 2 psi.



CARBIDE, HSS, AND SOLUBLE OIL are used for turning, facing, forming, grooving, drilling and grinding 150A titanium. Tools are conventional and have good life in producing gas pistons for a 20-mm jet-fighter gun

Conventional tools





AUTOMATIC BAR-MACHINE OPERATIONS include turning two dials, forming grooves and a radius, center drilling and cutting to length. Production rate is about 20 pieces per hour with carbide, HSS tools and soluble oil

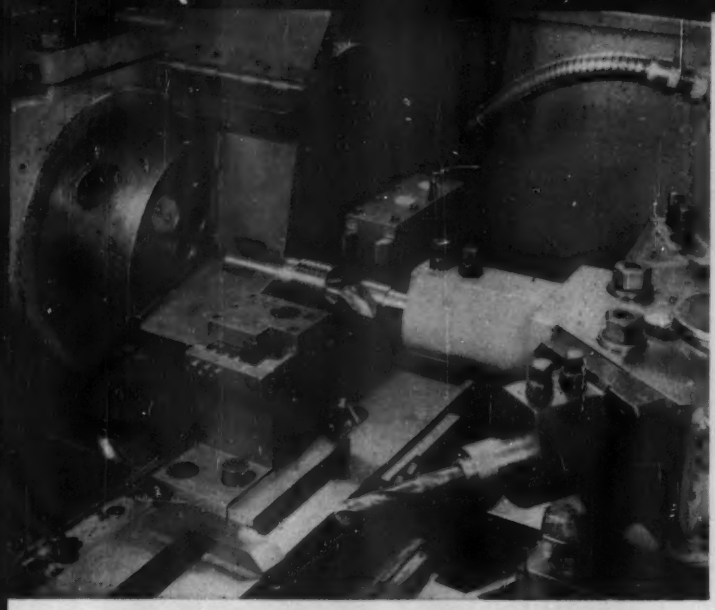
Although considerable development work went into the problem, 150A titanium is now machined as a matter of course at Pontiac. Here are typical operations in producing an aircraft-gun part

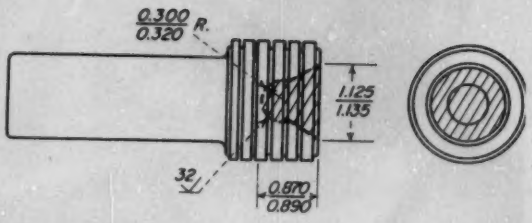
A great deal of experimental work was needed to achieve good results in machining titanium at Pontiac Motor Co's M39 gun plant. Various speeds, feeds, coolants, and tool designs were investigated until a combination was found that now permits machining this material in a routine manner. Methods employed are not far from conventional practice used with other materials, although hardness of the titanium stock is extremely important and is a prime factor in its machinability. Best results obtained here are with grade 150A having a hardness of R_c 34-36. Even carbide tools chip and break as the result of seizing if the material is harder or softer by as little as a few points, so all material is closely checked for this characteristic before use.

The best example of machining methods can be had from the variety of operations required on a drum-cradle gas piston for a 20-mm gun used in jet fighter aircraft. This titanium part is turned, faced, grooved, countersunk, drilled, formed and ground.

CARBIDE AND HSS USED WITH SOLUBLE OIL

First operations on this part are performed in a 4-spindle Acme-Gridley automatic bar machine to which 1⅞-in.-dia bars of 150A titanium are fed.





HSS TOOLS PRODUCE spherical radius and a countersink in one end of the gas piston in this turret-lathe setup. Production rate is approximately 12 pieces per hour, tool life runs over 100 pieces between grinds

machine titanium

ROLAND SATTERLEE, supt, M39 GUN PLANT
PONTIAC MOTOR CO, DIV GMC, PONTIAC, MICH

Here two dias are turned, one end is faced and center-drilled, grooves are formed in the larger dia and the part is cut off to length. Rough turning the smaller dia, (1.130-1.135 in.) is done in the first station, where either Carboloy 44A or Kennametal K6 are employed for a cut 5/16 in. deep with a feed of 0.008 ipr and a spindle speed of 172 rpm. The same speeds, feeds and grade of carbide are used for semi-finishing this dia in the second station with a 1/16-in. deep cut. Simultaneously, a breakdown tool enters the bar at the large end to prepare it for the cutoff tool later. Here, a 5/16-in. deep cut is made at 0.003 ipr.

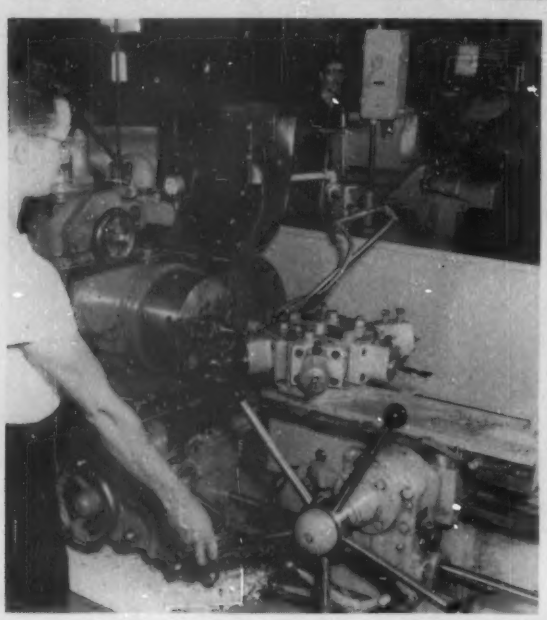
At the third station, a 2-fluted HSS end mill faces the small dia, removing about 1/32-in. of stock at a feed rate of 0.008 ipr. This tool is conventional in every respect except it is ground with a very small land to provide a sharp shearing angle. Turning and grooving the large dia is also done in this station where 1/16 of stock is removed from a side at 0.008-ipr feed. Grooves are 1/16 in. deep by 0.060 in. wide and are produced at a feed of 0.0025 ipr from the cross slide with a circular form tool having carbide inserts. Blades on this tool are designed to cut wedge-shaped grooves, therefore cut themselves free as grooving progresses. Previously, considerable tool breakage occurred even with large side clearance. Parting is done in the fourth station with a HSS cut-off tool which runs as long as 800 pieces between grinds. Conventional soluble oil in proportions of 20 to 1 is used; rate is 15 to 20 pc per hr.

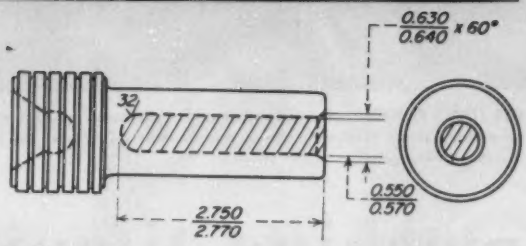
Tool life is good. For example, the end mill used for facing produces as many as 200 pieces between grinds, the carbide semi-finishing tool about 200 pieces. Roughing tools produce around 60 pieces between grinds and the grooving tool between 200 and 250 pieces.

TURRET-LATHE WORK

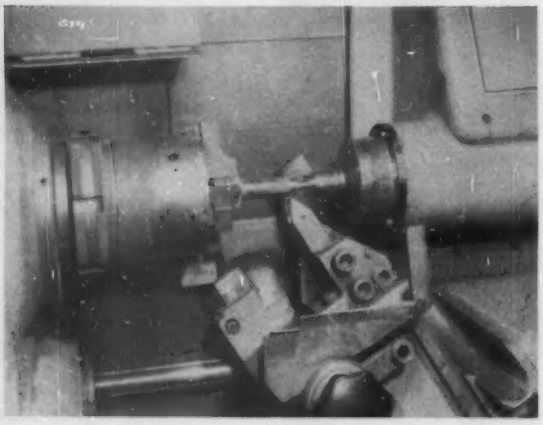
A No. 4 Warner & Swasey turret lathe is employed for countersinking and forming a spherical radius in the large dia. Work is held in a 3-jaw chuck on the small end while a 2-fluted HSS end-cutting form tool drills and countersinks the opposite end. A standard HSS 5/8-in. drill with a ball nose follows to produce the radius. Spindle speed is 108 rpm and feed 0.0045 ipr with soluble oil. Both tools produce over 100 pieces between grinds and production rate averages 12 pieces per hour.

Another turret lathe is used for drilling a 9/16-dia hole in the small end to a depth of 2¾ in. by gradually reaching full depth with 4 drills, each of

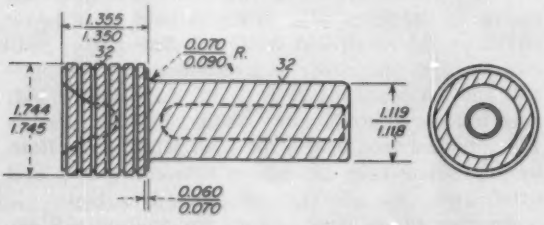




CONVENTIONAL DRILLS are used progressively to produce a deep hole. This provides a means of getting coolant to bottom where oil-hole drills were found to be too fragile. Drills are fed in, backed out, and fed in again to remove chips. Spindle speed is 420 rpm with a feed of 0.0075 ipr



CARBIDE TOOLS FOR CONTOUR TURNING are used after local hardening one end of piston. Copying lathe simplifies the setup because a templet has the desired contour and multiple tooling is not needed. To economize on material, short ends from bar stock in bar machines are turned in this lathe, too. Production rates are around 30 pieces per hour in removing 0.010 in. of stock from a side at a feed rate of 0.010 ipr and a spindle speed of 425 rpm



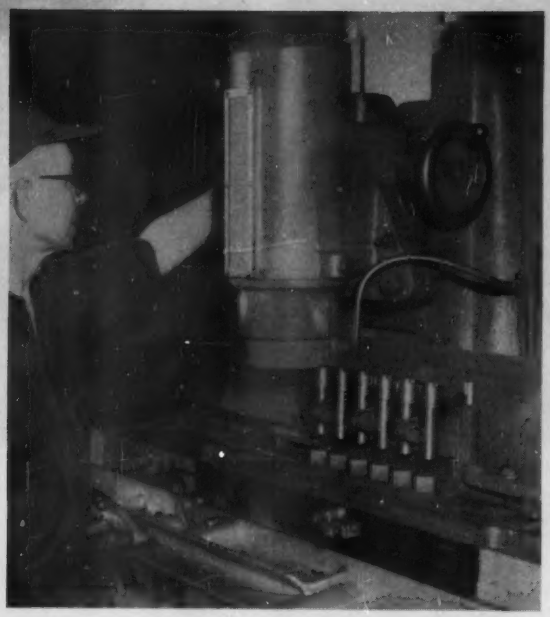
CYLINDRICAL GRINDING to 0.001-in. tolerance is accomplished with a wheel speed of 3800 to 4200 sfpm and a work speed of 75 sfpm. Silicon-carbide wheel is used with heavy-duty soluble oil

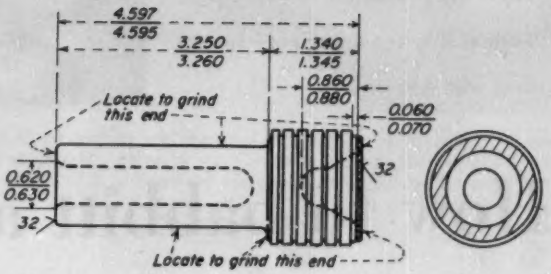
which enters up to ¾ in. This, of course, eliminates tool breakage and increases tool life. It also overcomes the big problem of getting coolant down into a hole of this size and depth. Conventional oil-hole drills have been found too fragile for the job.

CAREFUL DRILLING TECHNIQUE

In this setup, as in the one prior to it, the work is held in a 3-jaw chuck while a center drill enters to start the hole. Each of the four drills follows in turn, it being necessary to feed them in, back away to clean out chips in the hole and on the drill, then feed in again. Forcing the drill and not getting chips away causes most of the difficulty often found in drilling titanium. A drill that splits up the web indicates too great a feed or insufficient lip clearance at the center, while rapid wear at the extreme outer corner of the cutting edge shows that drilling speed is too high.

Numerous combinations of angles were tried until it was found that the conventional 59° point angle gave the most satisfactory results. A 14 to 15° lip-relief angle is also used together with other standard drill features. A high spiral is useful for removing chips, and HSS drills of this type give excellent results. Again, conventional soluble oil is used with a feed of 0.0075 ipr and a spindle speed of 420 rpm. Last of the four drills has a ball-shaped nose to produce the spherical radius and to clean out the





SIX AT A TIME is the setup in surface-grinding pistons in a special fixture. Work is held and located in V's, turned over for grinding opposite ends. About 0.001 in. downfeed is employed in removing approximately 0.010 in. stock from each end, coolant is heavy-duty soluble oil

drill point in the hole. This is followed by a countersink. Production rates run about 8 pieces per hour.

CONTOUR IN COPYING LATHE

A local hardening operation follows drilling to bring the small dia up to R$_c$ 49-51 for a length of 2 in. This is followed by finish-turning the small dia, facing and forming a radius on the small end and finishing the radius at the junction of the two dias. A Fischer copying lathe simplifies tooling, carbide single-point turning tools being employed with a templet having the desired contour. About 0.010 in. of stock is removed from a side, and no coolant is used. As the relatively light cut produces fine chips, care must be taken to avoid fire. Experience has shown that chips from cuts of 0.005 in. per side will glow and finer chips will ignite. Heavier chips, say 0.010 to 0.015 in. thick, are considered less of a fire hazard but are watched nevertheless when running without a coolant. A feed of 0.010 ipr is used with a spindle speed of 425 rpm, and production rates are around 30 pieces per hour.

Grinding the small and large dias to finished sizes, 1.119-1.118 and 1.744-1.745 in. respectively, and cleaning up the shoulder is the next step. This is done in a Norton cylindrical grinder with a 30 x 4-in. silicon-carbide wheel of medium hardness and grain size and of fairly open structure. Wheel speed is 3800 to 4200 sfpm, while work speed is 75 sfpm. A plunge cut made on the small dia includes the shoulder radius. About 0.007 in. of stock is removed from this dia and 30 to 35 pieces are ground before wheel dressing is required. On the larger dia, stock removal is 0.011 to 0.016 in. and 40 to 45 pieces can be ground between wheel dressings. It may be noted here that the hardened surface breaks the wheel down faster than the unhardened section does. Coolant is 1-6 heavy-duty soluble oil and water.

Final operation is to grind the ends to length, 0.015 to 0.020 in. of stock having been left on the ends to insure maintaining length tolerances. This operation is performed in an Abrasive vertical surface grinder equipped with a special fixture in which 6 pieces are held. Work is located in V's supported under the shoulder with the large-dia end up. A down-feed of 0.001 in. is employed to remove about 0.010 in. stock. The opposite end is ground after pieces are reversed. They are supported on the ground ends. Same feed is used to remove about the same amount of stock and, in both cases, spindle speed is 3600 rpm. Wheel is a 6-in-dia, plate-mounted, medium-grain, medium-hard, open-structure type and the coolant is the same as that for cylindrical grinding. Approximately 30 pieces per hour are ground in this setup. To avoid possible fires, the coolant is always turned on before the first spark to prevent ignition of fine dust particles that adhere to the inside surfaces of machine guards.

LENGTH, THICKNESS, AND DIAMETER of old liner are measured to compute the amount of babbitt metal required for replacement. Enough material must be melted to permit pouring the entire bearing at one time to avoid cold shuts, laminations, or folds

Every self-respecting mechanic knew the process fifty years ago. Today, it is becoming rare to find one who knows . . .

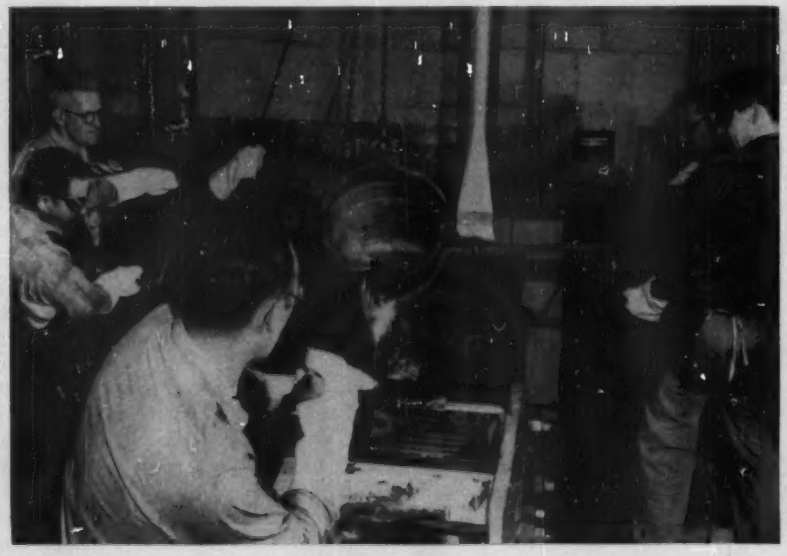
How to babbitt a large bearing

One of the oldest, and still one of the most reliable, bearing materials is babbitt metal. It is widely employed yet, strangely enough, there is a real paucity of information on how to apply it, and the operation of babbitting is fast approaching the status of a lost art. The accumulated skills and know-how required for babbitt work are found in relatively few machine shops nowadays.

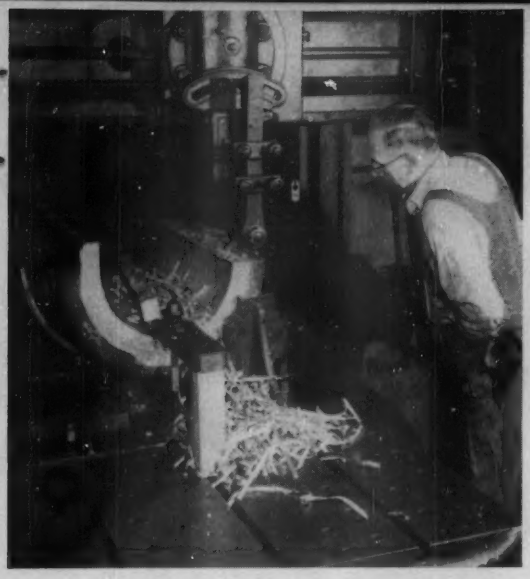
Recently, a main bearing of a large generating unit was re-babbitted in the shops of Consolidated Edison Co, New York City. Principal steps are shown in accompanying illustrations.

For satisfactory results, the entire liner should be poured at one time, so the old liner's length, diameter, and thickness are measured to permit computing the amount of metal required. Note the condition of the bearing in the first illustration. The surface apparently failed from metal fatigue. Breakaway of liner metal generally occurs when the applied stresses exceed the fatigue strength of the

WORN LINER IS MELTED from the shell which is then carefully cleaned and etched. Shell is next dipped in flux at 150 F, then into a bath of molten tinner's solder held at 150 F above liquidus temperature. Shell is not allowed to cool before casting the liner



MANDREL IS POSITIONED inside shell and is heated about 100 F higher than shell temperature so solidification can progress from shell to mandrel. Stream of metal is poured against and moved around the mandrel to prevent local overheating



EXCESS METAL is planed off joint surface. Mould is purposely extended above the top of the shell to provide a reservoir for shrinkage and trap floating impurities. Babbitt is machined away to bring it flush with the surface of the shell

BOTH HALVES of the bearing are assembled on the table of a boring mill, end faces squared up, and hole bored to size. Completed bearings are re-installed and aligned by a collimator in a fraction of the time formerly required for piano-wire alignment

H E LINSLEY associate editor

bearing alloy, and any condition producing repeated overloads on the bearing surface may result in this fatigue and breakout.

Because downtime on generators is extremely costly, Con Ed seeks to avoid it by good re-babbitting practice. This includes making sure of the right bearing metal for the job, securing a good bond between liner and shell, and avoiding porosity, segregation of metal constituents, and hard spots which might score the shaft.

HERE'S THE PROCEDURE

Melt worn metal from the shell by a gas torch and collect it in a drip pan. However, because it may contain impurities, do not re-use it in the new melt but send it to a smelter for refining. In the accompanying photograph of this operation, note the longitudinal and peripheral dovetail keyways which serve to anchor the babbitt mechanically.

When the shell was originally machined, the final cuts were taken dry to avoid impregnating the surface with oil but, because contamination may have occurred in service, degrease the shell in alkaline cleaner at just below boiling point, then etch for three to five minutes in an aqueous solution of 50% hydrochloric acid at 160 to 180 F. If not scrupulously clean, repeat this operation.

After cleaning, dip the shell in flux, usually a saturated solution of two parts zinc chloride and one part ammonium chloride in water, held at 150 F. Then dip in molten bonding alloy (tinner's solder) kept about 150 F. above its liquidus temperature. If properly cleaned and tinned, the shell surface will have a bright, silvery appearance.

Pouring is the next step, and this is performed before the shell cools from the tinning. Preparation of the babbitt, however is highly important. Generally speaking, tin-base babbitts are best for high speeds and heavy-duty service; lead-base for medium or low speeds and loads. A typical material for important heavy-duty work is Federated Metals Thermodyne which has a dense, fine-grain structure with an as-cast hardness of 26 Bhn. Compressive strength is 16,875 psi at 10% deformation. The melting pot must be clean, and should be heated uniformly to prevent segregation. Stir thoroughly and check temperature at 950 F before pouring.

Place the bearing shell in a mold with dam-plates at the ends, and a mandrel centered inside it. Preheat the mandrel to about 100 F above the shell temperature to insure solidification of the babbitt progressively from the shell to the mandrel. The shell temperature at pouring should be well above the melting point of the tinning metal.

HAVE ENOUGH METAL

Pour the molten babbitt against and around the circumference of the mandrel to prevent local overheating, and be sure the melt is large enough so the entire bearing can be poured at one time to avoid creating defects. Occasionally it may be necessary to top-up the mold with hand ladles. After pouring, cover the mold with sheets of asbestos to prevent too-rapid cooling of the surface. Bubbles will form toward the surface crust if the casting is permitted to simmer.

After the bearing has cooled, machine off the excess metal on the joint surface, assemble the two halves, and finish bore to size. When re-assembling the bearing in the machine, make sure all foreign materials, such as dirt, chips, and lint are wiped from shaft and bearing with lint-free cloths, adjust clearance carefully, and make sure all clamping bolts are tensioned evenly. Alignment is, of course, extremely important, and Con Ed now checks this by means of a collimator. This produces accurate results in only a fraction of the time formerly required when checking with a piano wire.

Round Table

Accident-Proof, Foolproof

"Seeing is believing, Ed. I just can't get it out of my mind—the way Bill Lacy got hurt yesterday."

"What was he doing, violating the goggle rule, as usual?"

"Sure. Just like everyone else, he got tired of wearing them just before he snapped his tool; and that was it."

"Maybe we ought to get photos of him in the hospital and paste them up all over the plant. It might teach the rest of the men a lesson."

"That's an idea, Ed. But I was thinking about how we could make it easier and more comfortable for the men to wear safety glasses and goggles. Why can't we get a licensed optician in once a week to fit them to each man individually?"

"Too much expense for this shop, Al. I don't think the financial boys would go for it."

"They ought to, Ed. It's time we did something constructive about safety instead of just having lectures and posters around. They don't convince anyone that it's sense to make sure of safety."

"Maybe the answer is to enforce some of those company rules that nobody takes seriously. Did you know that every application blank for a job says any employee violating a safety rule may be fired without notice?"

"Yeah, but when was anyone ever canned, Ed? Not that I can remember. Besides, you'd have to fire everyone in the plant if you enforced it."

"Maybe not many, after the first one or two, Al. The rest of them would catch on mighty quick."

"That's too drastic, Ed. I'll bet there's not a plant in the country that ever fired more than one man for violating a safety rule, if any. I think we ought to take the responsibility ourselves and make sure the men stick to safe practices."

"You'd be doing it all the time, Al, and leave no time for regular work. I don't know—I guess safety is just a hopeless fight."

"It doesn't have to be, Ed. If we could prove to management that they'd save cash on accident claims by having in an optician to fit glasses to every man in the place, we'd be that much ahead."

"Sure, and then some damned fool would drop an angle iron on his foot—just a few minutes after he's been told to get safety shoes."

***WHO** is responsible for plant safety—management or the shop men themselves? If management provides proper safety equipment and reminders, yet the men don't conform, what can be done? Your idea on the subject can help prevent accidents. Discussions of earlier topics appear on later pages.*

American Machinist

SPECIAL REPORT
NUMBER 372

how to understand

COLD WORKING OF METALS

SAMUEL STORCHHEIM, metallurgical engineer

Cold shaping of metals has always been important for primary products like bars, sheet, strip and wire, and in metal stamping. But plastic deformation of primary products into finished parts with little or no machining is now capturing the imaginations of production executives. To know your way about in this field, you have to know the metallurgical "facts of life". These are told in simple language in reference to effects of prior processing on the metal, its grain structure, work-hardening rate, etc., so that you can estimate what will happen to the mechanical and other properties when you cold work a material.

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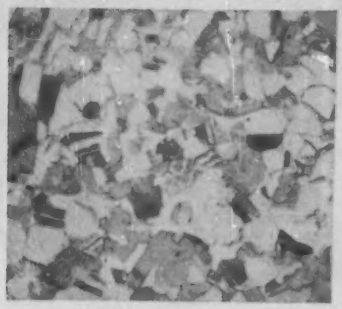
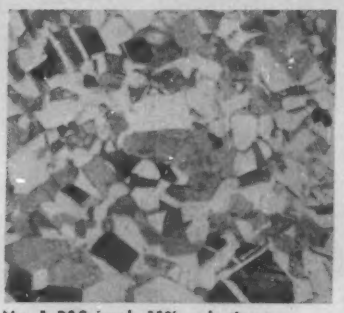
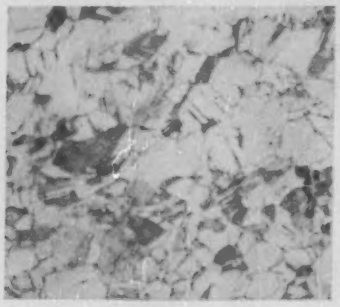


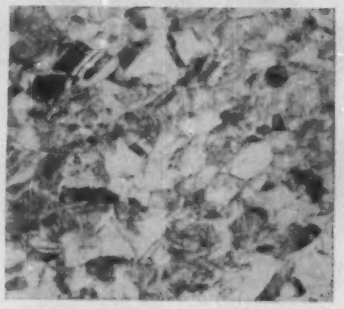
Annealed—soft



No. 1 B&S hard—11% reduction



No. 2 B&S hard—21% reduction



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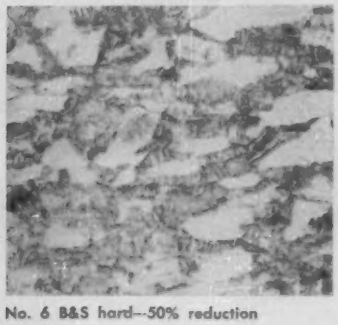
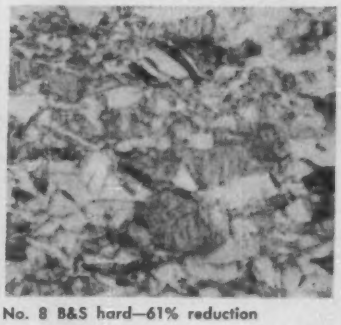


No. 6 B&S hard—50% reduction



No. 8 B&S hard—61% reduction

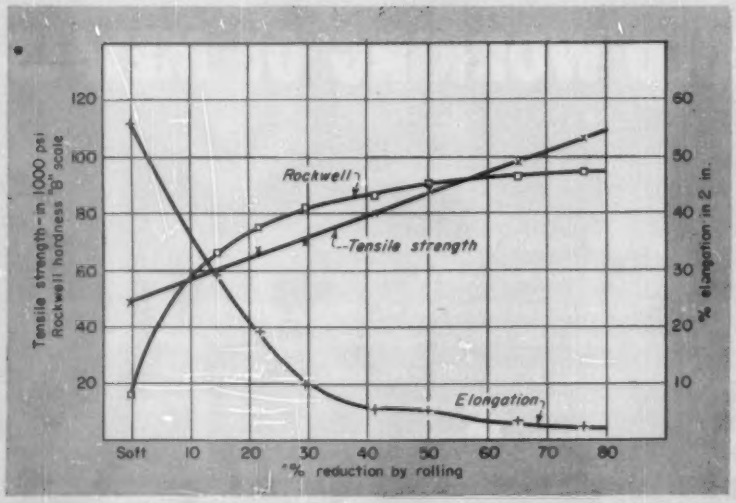


FIG. 1 ... Grain structure of a metal is distorted and elongated in the direction of cold working (cold rolling in this instance) in proportion to the percentage of reduction in thickness. Mechanical properties of the brass (70 copper-30 zinc) are likewise affected by cold reduction

Prior treatment

For an understanding of how metals respond to cold working, you should refresh your memory on two matters:

1. How metals respond to heat treatment and how they solidify from a molten mass (*AM* Special Report No. 361, April 26, 1954.)

2. Crystalline or grain structure of metals (*AM* Special Report No. 345, Sept 28, 1953.)

These subjects are all part of the fundamental theory of metals. But if you do not have these Reports at hand, a short resume of them will lead us into our subject.

We learned previously that as a molten metal solidifies, tiny particles come out of the molten mass as solids, and that the solidifying mass builds up around these particles or little islands. Where the growing particles meet, we call these areas "grain boundaries" and the particles "crystals" or "grains." We also learned that impurities in the molten mass will be ejected to the grain boundaries if solidification is slow enough; if it is very rapid, the impurities can be trapped within a growing grain.

SEGREGATED IMPURITIES

These impurities, when segregated at the grain boundaries, can have a decisive effect on the physical properties of the solidified metal. They can cause harm during working or heat treatment.

When the metal is a solid, it may be or may not be in the form that we ultimately desire. It may not have the physical, chemical or electrical characteristics ultimately needed. The trick is to change the metal structure to whatever we wish. This can be done by the proper amount of deformation, either hot or cold, and by subsequent heat treatment.

Normally, if we leave the metal in the as-cast condition, it will have lower strength than if wrought; that is, worked or deformed. In addition, castings may have a number of imperfections not common to wrought materials. Examples are blow holes, pipes, composition

affects cold working

segregation. To avoid these defects, attain greater strength and obtain the shape desired, we deform the metal either hot or cold. Our question is: how does a metal respond to cold deformation?

MECHANISM BY WHICH METALS DEFORM

When we work metals at or somewhat above room temperature, the process is known as "cold working." Under these conditions we generally obtain surfaces that are not oxidized, dimensions of greater accuracy than normally obtained, and usually an increase in hardness and strength. The tensile strength, elongation, hardness, electrical resistance, etc., induced in a metal depend to a large extent on the degree or amount of cold deformation.

What actually happens when we cold work a metal?

As discussed, we know that a metal is composed of grains. These grains, after casting, are normally of a uniform diameter; that is, they are equiaxed in three dimensions: length, width and depth. The grains are held together by geometric lockings, as well as by what we call their "surface energies." When the grains are subjected to cold deformation—forging, rolling or wire drawing—they fragment; that is, they break up and elongate in the direction of deformation. For example, if you draw wire to more than 40% reduction in area, the grains elongate and contract (fibering) parallel to the wire length. In forgings, the grains "flow" along contours set up by the restrictions imposed in the forging dies. This fibering and flowing is called plastic deformation.

Plastic deformation or flow occurs in certain definite ways in every metal, the manner of flow generally varying with the type of metal. From Special Report No. 345 we learned that metals deform where the greatest number of atoms are concentrated; that is, along planes of greatest atomic packing, and in the direction in which this packing is greatest. To see this more clearly, take a deck of cards and move them gently. You will see that they slide along one another. This is how the planes of atoms in a metal slide past each other during a deformation process, assuming that each card represents a layer of atoms.

This sliding of planes is an atomic picture. Fragmentation; that is, the breaking up of the grains, is a macro or enlarged picture and involves large numbers of atom planes. Normally, we refer to the moving of these planes as flow or slip. Usually slip or flow continues

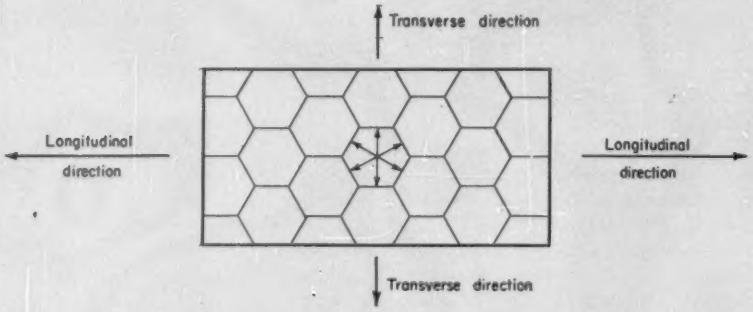


FIG. 2 ... Equiaxed grains are those having equal paths across them in all directions. Mechanical properties of this structure are alike in the longitudinal and transverse directions

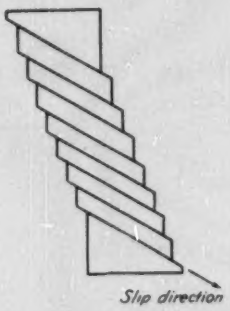


FIG. 4 ... Deformation of a metal as a result of slip can be compared to a stack of checkers pushed out of alignment, but not toppling over. Normally, slip occurs at 45° to the stress applied to the metal

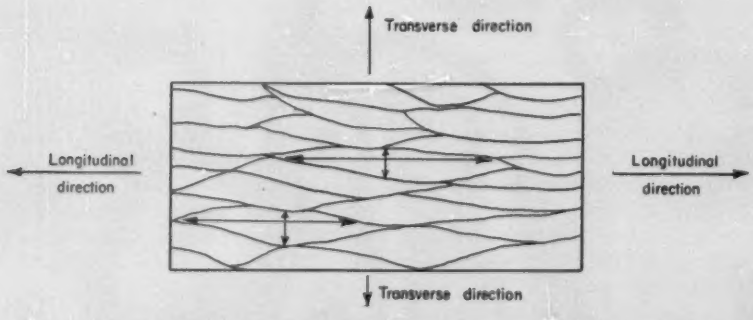


FIG. 3 ... Clean metal after cold deformation. The grains are now elongated parallel to the longitudinal direction, paths from grain boundary to grain boundary are not equal, and the mechanical properties now differ in the longitudinal and transverse directions

Photographs and charts pertaining to copper alloys are reproduced by permission from the "Technical Handbook" published by Bridgeport Brass Co.

until the set of planes involved can no longer slip; that is, they are locked in position. When this occurs, depending upon the type of atomic structure, slipping occurs in another direction by other planes of atoms. This process continues until the slipped planes are locked. Eventually no further slip can take place. Then ruptures occur if we continue to try to deform the cold-worked metal. When we reach this point, annealing of the metal must be done if we hope to continue the cold-working process.

During cold working of metal, the slip planes usually lie at 45° to the direction of applied stress. Iron, and almost all of its alloys, will deform locally along these planes. When the deformation is tensile in nature, stresses are set up pointing from the interior of the metal to the surface, and grooves form on the surface. When the deformation is compressive, the stresses point towards the interior of the metal, and ridges form on the surface. These lines of flowed metal are called "Luders lines." They are also called "stretcher strains" in metal-stamping shops.

Continued deformation causes local hardening around the flowed area. These hardened areas resist deformation. Flow stops after a band of deformed metal called a "worm" has formed. The flowing process then shifts to softer regions, and continues until the bands cover the whole surface area of the metal. Eventually, the worms can no longer be distinguished individually.

This process, which holds true for deformable metals and alloys, does not allow local build-up of stresses to the point where the metal thins and ruptures. Without this process, the fabrication of sheet, strip, wire, forgings, etc., would be virtually impossible.

Work-hardening rate requires consideration

Chart for rapidly determining which metals can be cold worked

(Process Performed at or Near Room Temperature)

Metal	Is Cold Working Practical?
Aluminum	Yes
Brass	Yes
Bronze	Yes
Copper	Yes—easily
Iron	Yes
Lead	Yes—Quite easily
Magnesium	No (best between 300 and 500 C)
Molybdenum	No
Nickel	Yes
18-8 Stainless Steel	Yes
Steel:	
Low carbon-soft	Yes
Structural	Somewhat (best between 900 and 1100 C)
High carbon	No (best between 700 and 1100 C)
Tin	Yes—very easily
Titanium	Yes
Tungsten	No (best between 600 and 1600 C)
Zinc	No (best between 110 and 150 C)
Zirconium	Yes

One of the most important characteristics of metals is the rate at which they work harden. This means the speed with which they obtain maximum hardness with increasing reduction or cold deformation. Some metals will harden much more rapidly than others. This explains why certain metals must be annealed more frequently than others. Sometime rapid work hardening is beneficial, sometimes it is detrimental. An example: a metal that cold works rapidly is rhenium—one of the less-known metals now being studied by the electronics industry. This metal work hardens with extreme rapidity and requires frequent anneals after only small reductions of area. On the other hand, copper can be reduced severely without frequent anneals. The same is true for gold or aluminum.

Slight variations in chemical composition of alloys can strongly affect the rate of work hardening. In 18-8 stainless steel, an increase in nickel from 8 to 10% lowers the rate of work hardening considerably. On the contrary, an alloy with 8% Ni reaches maximum hardening at a much lower percentage of reduction than say a 10% nickel alloy.

When we have a metal that work hardens rapidly, we find in wire drawing that we get excessive die wear. In addition, with increasing percentages of cold reduction, there are more frequent ruptures or failures of the alloy. On the other hand, if a metal does not work harden rapidly, a considerable percentage of cold reduction is required before we can attain high strengths. The fewer the anneals between the reductions, the lower the cost of fabrication.

IMPURITIES AND DEFECTS AFFECT COLD REDUCTION

Impurities or inclusions in the metal can be extremely important to the success of coldworking. Normally, foreign matter can be picked up in the melting, casting or working of the metal. This can come about from a variety of causes; oxidation products, melt or mold pick-up, and carry-over impurities from the raw material.

Almost always, oxide inclusions are hard, have high melting points and do not dissolve in the mother metal. The metallurgist refers to these constituents as insoluble refractory inclusions. The same explanation given for oxygen reactions can also be true for nitrogen contained in the air.

To minimize the effect of the air-molten metal combination, foundrymen flux the active melt with silicon, aluminum, calcium, etc. These metals combine with the oxygen in the metal and float to the top of the melt where they are skimmed-off. Another technique is melting in vacuum.

Impurities picked up from graphite containers may form car-

bides. These are usually insoluble refractory constituents.

Sometimes, when metals are being deformed, impurities or imperfections on the surfaces can be worked-in or embedded in the metal. Attempts to avoid this are made by machining or pickling the ingots, billets or bars.

Inclusions are elongated and/or fragmented much the same as the grains of a metal, while the metal is being deformed. When this occurs, the distances between discontinuities are shortened and failure can occur readily.

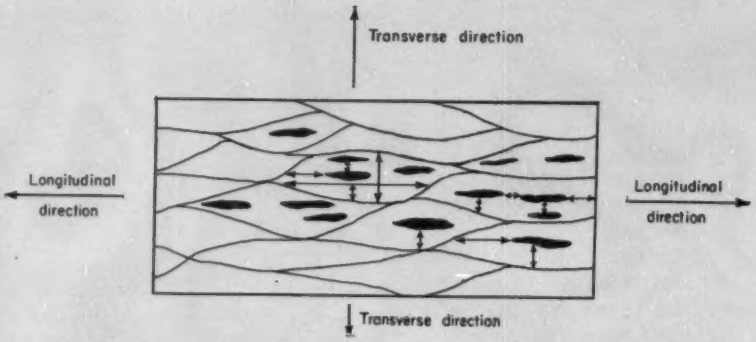


FIG. 5 . . . Impurities or inclusions in the metal are coldworked into stringers while the grains are being elongated. Paths from inclusion to inclusion are shorter than from grain boundary to grain boundary, and mechanical properties are impaired compared to clean metal

NOTCH EFFECT

If the imperfections or inclusions have sharp corners they create stress-concentration areas and fail more readily than if they are rounded. This is sometimes referred to as the "notch-effect." An excellent example occurs in grey cast iron. Here, excess carbon is in the form of sharp-cornered graphite flakes. This type of cast iron is noted for its brittleness because of the notch effect. To avoid this serious disadvantage, metallurgists rounded the sharp flakes into nodules.

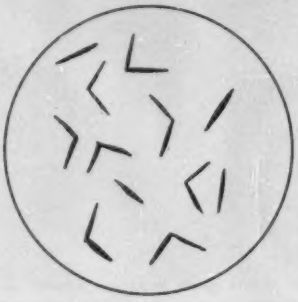


FIG. 6 . . . Sharp-cornered constituents in a metal, in this case graphite flakes in gray cast iron, will localize stress concentrations and lead to brittleness

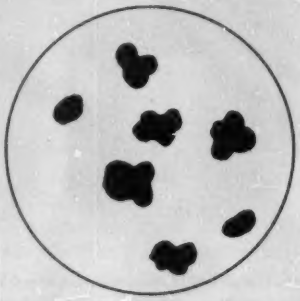


FIG. 7 . . . Ductility is achieved by treating cast iron so that the graphite particles become nodular, or rounded. Areas for localized stress concentrations are no longer present

Further examples of how inclusions can cause considerable damage to metals during forming are:

Wire or rod will fissure or split at inclusions. Fissuring and splitting can cause further rupture and eventual failure of metal while it is being formed.

In forging, excessive pressures will cause the metal to burst, usually at locations of inclusions. Sometimes, the material does not rupture completely, but splits or fragments partially at the surface. Continued working buries or covers up these fissures, but they are not necessarily healed, or welded together. Mainly, the reason for this is that an oxide coat forms on the surface of the fissure and prevents welding.

Failure to eliminate buried imperfections in the material, say wire, can cause loss or imperfect properties in the fabricated article. If a covered fissure allows the notch affect to take place, rupture will occur at a much lower stress than perfect material. If the wire is used for heating purposes, the inclusion is almost always a poor electrical conductor, may take up part of the area of the wire. This means that extra current is forced to flow around the inclusion through the smaller clean area of the wire. This, in turn, causes excessive heating of the smaller area and burn-out can occur prematurely.

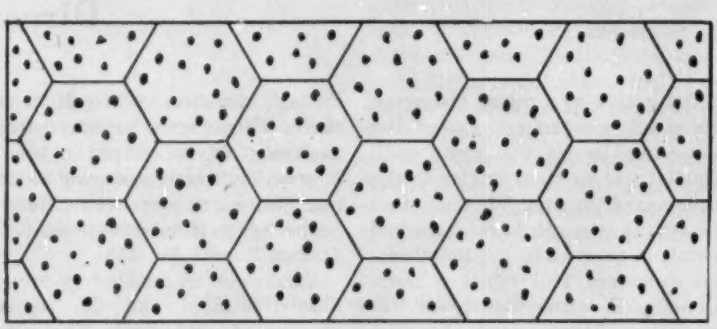


FIG. 8 . . . Impurities like sulfur or lead are deliberately added to a metal to improve machinability. The more uniform the distribution the better the machinability

So far we have seen undesirable example of inclusions. But there are beneficial ones too. In sulfur-bearing carbon steels, sulfur is deliberately added to form iron sulfide in discrete particles. Little islands of sulfides are distributed within the matrix of the metal. At machining, the chips break off in short lengths and the steel or the material under consideration becomes known as "free-machining." The same free machinability is obtained in brasses and steels by the addition of lead, which remains uniformly distributed in the matrix.

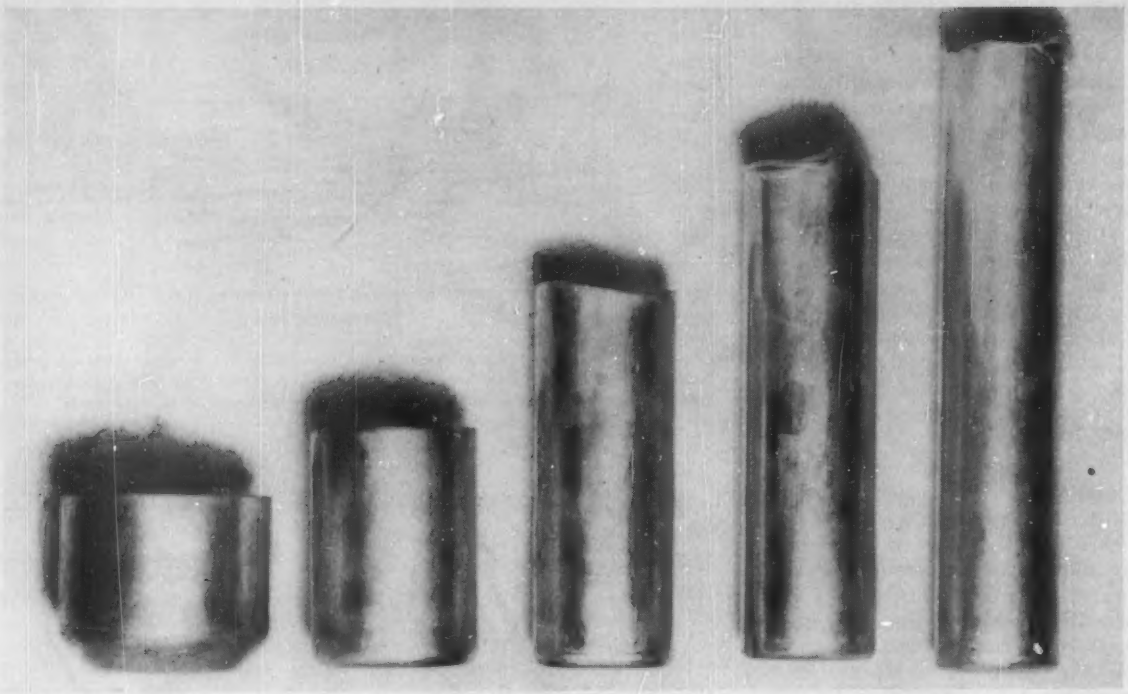


FIG. 9... Metal with excessive preferred orientation of the grain structure (aligned mostly in one direction) is not suitable for the critical diameter reduction and wall thinning required to make this brass flashlight case. Excessive preferred orientation would lead to "ears" and variations in wall thickness

Directional properties affect

If the grains of a metal are being elongated, we can not expect the properties to be the same both parallel and at right angles to the direction of working. We know that the tensile strength of cold-worked metals is greatest in the longitudinal direction. This effect is more pronounced with severity of deformation. Elongation is likewise best in the longitudinal direction. Why? In worked metals, the discontinuity effect is exaggerated in the transverse direction. The paths between discontinuities, or grain boundaries, are shorter in this direction.

NON-UNIFORM FLOW

Besides variations in strength caused by elongation during cold work, metals exhibit non-uniform flow during subsequent forming operations. Aluminum or brass can develop "ears" or a scalloped edge, as well as varying wall thicknesses during drawing of cylindrical shells. This effect is produced from alignment of the planes of atoms in specific directions during working. Hence, the metal has different properties in these directions. (*AM* Special Report No. 345).

Earing can be avoided by proper heat treatment and the correct amount of cold work. The more random the alignment of the atom planes, the more uniform the properties of the metal in all directions. But, random alignment does not necessarily provide the desired final properties in all cases. If earing is to be avoided, randomness is wanted. However, maximum strength is not attained and can only be produced by more cold reduction. This of course means more preferred orientation. As in almost all types of metallurgical processes compromises are necessary.

Cross rolling is one technique employed to avoid excessive preferred orientation in rolled strip. This means that the strip is first rolled in one direction and then it is turned 90° and is rolled in the transverse direction. This process is continued until the desired strip thickness is attained. The effect is to even out the grains more or less.

EFFECTS OF RESIDUAL STRESSES

Cold deformation sets up stresses in metals—either tensile and/or compressive. Metals under purely compressive stresses do not fail; only when tensile stresses also exist do failures occur. One of the basic reasons for shot-peening is to set up compressive stresses in metal surfaces. These stresses counteract applied tensile stresses in service, and thereby help to avoid failure.

The stresses set up in drawn bars or wires are tensile on the surface and compressive at the center. Stresses in order of 30,000 psi or higher can be permanently intro-

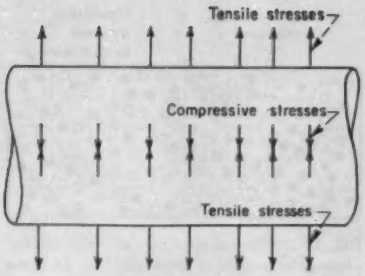


FIG. 10 . . . Cold-worked bars contain residual tensile and compressive stresses. Failure at the surface can occur more readily than if no tensile stresses were present

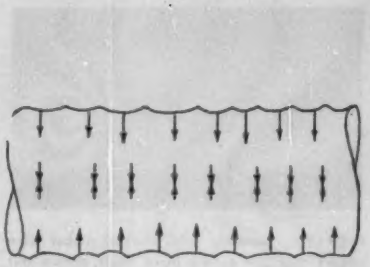
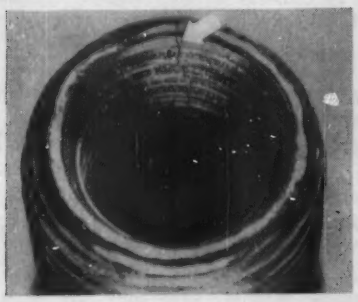


FIG. 11 . . . Shot peening of a cold-worked bar raises the strength because the residual surface stresses are changed from tension to compression



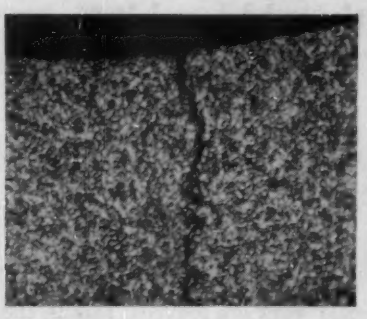


FIG. 12 . . . Stresses and heat generated by tapping a brass tire-valve stem with a dull tool caused cracking. See transverse section through crack. 75X

cold working

duced into a cold-worked metal. If the yield strength of a metal (the stress at which it starts to plastically deform) is 35,000 psi, and it already contains a 25,000 psi internal tensile stress, then application of only an additional external tensile stress of 10,000 psi will cause the piece to deform in service.

If bars stressed by cold working are machined, the dimensions change. This is brought about by a rearrangement of the stresses within the remaining metal, and accounts for distortion of parts machined from cold-worked stock. Many times, the stressed metal is heat treated to relieve these stresses, either partially or completely.

WORK SIZE AFFECTS FINAL STRENGTH

The size of the metal piece being deformed also affects the strength finally attained during deformation. The heavier the section the lower the strength for the same percentage of deformation. This becomes more pronounced the smaller the section being cold worked. To illustrate these last remarks the maximum full-hard strengths of 18-8 stainless steel wires of different diameters are:

Diameter	*Tensile Strength*
Mils	*Psi*
200	196,000
140	204,000
100	212,000
40	230,000
20	260,000
4	292,000

As the size of the metal piece being deformed decreases, the deforming pressure is more uniformly applied. This means that the various internal sections are fragmented and elongated more uniformly and thoroughly. Increasing deformation increases strength. Thus, better use of the deforming stresses (pressures) causes higher strengths, and that is what we usually want.

Another example is fine tungsten wires. These attain strengths as high as 500,000 psi. Only in fine wires are such high values achieved. Why? Because of better, more thorough and more uniform utilization of the deformation stresses.

EFFECT OF DEFORMATION SPEED

Final strength of cold-worked metal is affected by the speed at which the operation is carried out. Normally, a faster rate of cold reduction imparts greater strength to the metal. On the other hand, by use of a slower rate of cold reduction, it is possible to deform a metal to a greater extent before rupture. Less deforming force is required.

Cold reduction affects mechanical properties

Tensile Strength, psi				
Metal	% Reduction			
	0	10	30	60
70:30 brass	43,000	48,000	60,000	90,000
18/8 Stainless Steel	130,000	160,000	210,000	250,000
Aluminum sheet	11,000	12,000	13,000	17,000
Steel Wire-0.39% carbon	100,000	105,000	120,000	140,000

Hardness				
Metal	% Reduction			
	0	10	30	60
70:30	B 19	B 63	B 85	B 92
25 aluminum	H 7	H 42	H 52	H 68
Armco Iron	G 3	G 45	G 63	G 68

FIG. 13 ... Unworked, annealed nickel wire has medium-size grains evenly distributed and fine grain boundaries. Areas bounded by straight, parallel lines are called "twins"

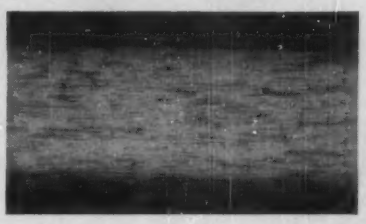


FIG. 14 ... Severely cold worked nickel wire shows that the grains have been drawn out into fibers, and the "twins" have disappeared. Etching shows that the surface areas (darkened) are more severely worked

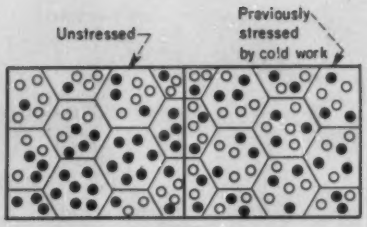


FIG. 15 ... Homogenization, or solution annealing, of metals is more effective on those that have been cold worked. Distribution of atoms in grains is more uniform for the previously stressed material

Properties change with cold working

Extensive property changes are caused by cold working, especially tensile strength, yield strength, hardness and elongation. The first three increase while the last one decreases. Hardness increases very quickly up to 10% cold reduction and then more slowly with increasing percentages of deformation. Tensile strength increases in fair proportion to percentage of deformation.

Typical examples of these mechanical-property changes for several metals are given in an accompanying table.

Electrical and magnetic properties are likewise affected. The electrical resistance of metals is increased by cold reduction. The purer the metal, the less the effect, usually only 2 to 5%. Alloys, however, exhibit greater increases, namely 20% for brass. An increase as high as 50% for severely cold-drawn tungsten wire (99% reduction) has been obtained.

Cold work greatly affects the magnetic properties of ferromagnetic materials such as iron, nickel, cobalt and a number of their alloys. The lines of magnetism that can be set up in such metals after cold work are reduced; that is, the magnetic pull is lessened. However, the ability of the metals to retain these lines (coersive force) after the magnetization current is turned off is increased. This effect can be an advantage or a disadvantage, depending on the end use of the material. Electromagnets (soft magnets) which should lose magnetism after the current is turned off would be detrimentally affected by cold work. Permanent magnets, those which are to remain magnetic, are aided. For example, small permanent magnets made of copper, nickel and cobalt, and used to generate electricity for flashlights, were improved by coining; that is, cold pressing, to final size.

Chemical properties of metals are likewise changed by cold deformation. Cold-worked materials react more vigorously to etching or pickling solutions. They corrode more rapidly, and they are also subject to corrosion cracking. In brass, the latter is known as "season cracking."

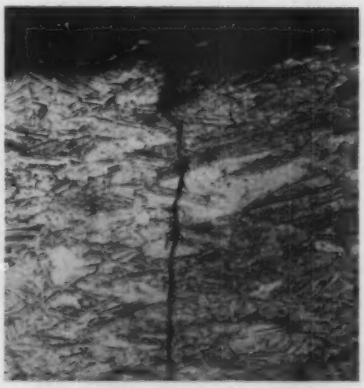


FIG. 16 ... "Season cracked" brass cup. Micrograph shows penetration of the crack. 75X

STORED ENERGY

Movement of atoms, or diffusion within a metal during heat treatment, is greatly increased by the degree of cold work, or the amount of energy stored up in the metal from the cold working process. Thus, homogenization, or solution annealing, processes are speeded up. It takes less time for a cold-worked metal to be homogenized than one in a soft, unstressed condition. Also, in alloys where precipitation hardening occurs, the process will be more uniform and rapid in cold-worked metals than in those which are annealed.

These various effects of cold working are brought about by storing up energy within the metal crystals. This pent up energy seeks an outlet. We can consider cold-worked metal to be in an unstable condition at room temperature; the metal wants to give up the tremendous energy that it holds. If we should relieve the stressed condition after deformation has given us the desired shape, the proper heat treatment should be specified.

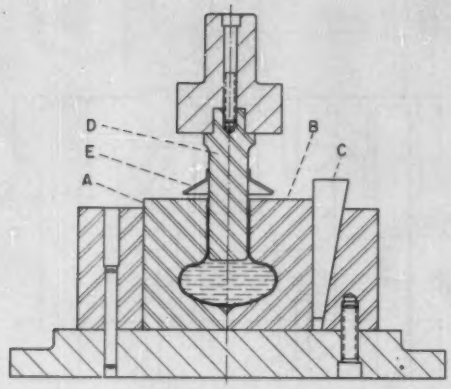


FIG. 1 . . . Wedge *C* holds the split fluid die together while the punch exerts pressure on the fluid to bulge the shell to the shape of the die

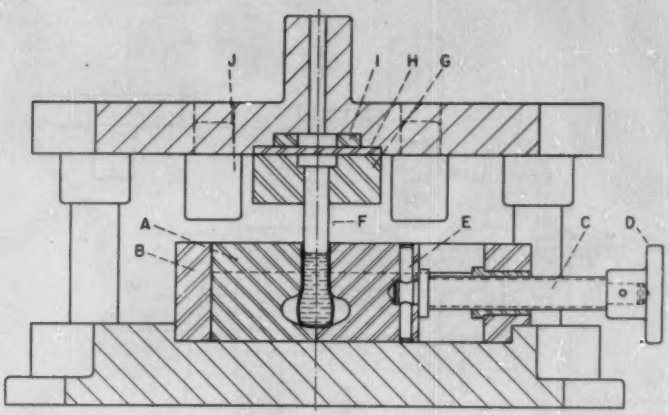


FIG. 2 . . . Screw *C* operated by handle *D* affords a more convenient means than a wedge for opening and closing the split die members. Punch *F* pierces plate *H* if too much fluid is placed in the shell and the press would be overloaded

Cope Talks on Draw Dies . . . XVIII

Fluid dies bulge shells and form ornamental designs

We gave you four methods of bulging shells in the previous instalment. Now the subject is completed with several types of fluid dies, a commonly used type. And since heading is a somewhat similar operation, dies for this type of work are included

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Shells are frequently bulged by filling them with a commercial cutting oil or with water, and displacing the fluid with a close-fitting plunger to bulge the metal out against the walls of a split die that incloses the work. Fluid dies are especially suitable for forming ornamental designs. If the inside surface of the die around the bulge is engraved with characters, figures or designs, the fluid while under pressure will emboss each minute line, thus making an attractive, finished product.

A very simple fluid die is shown in Fig. 1. The die consists of two halves, *A* and *B*, which are held in a steel holder with a wedge *C*. Punch *D* is made of hardened and ground tool steel, and is machined to fit the mouth of the shell closely.

In operation, the cup is filled with the proper amount of fluid and is placed in the die. The fluid must be carefully measured. If too little fluid is placed in the cup, the shell will not fill out completely. If too much is placed in the cup, the excess fluid will have no place to go and may damage the die or the press.

The split die is brought together tightly by the wedge, and the punch is allowed to descend into the shell. When the punch strikes the fluid, the latter is displaced and causes the shell to fill out and conform to the shape of the die. A thin brass guard at *E* prevents fluid that escapes past the punch from being squirted any great distance.

A faster and more satisfactory method of opening and closing split dies is shown in Fig. 2. Die *A* is made in halves, and is contained in ways *B*. It is opened and closed by a locking screw *C* operated by handle *D*. The screw prevents the die from spreading apart under high fluid pressure, which would

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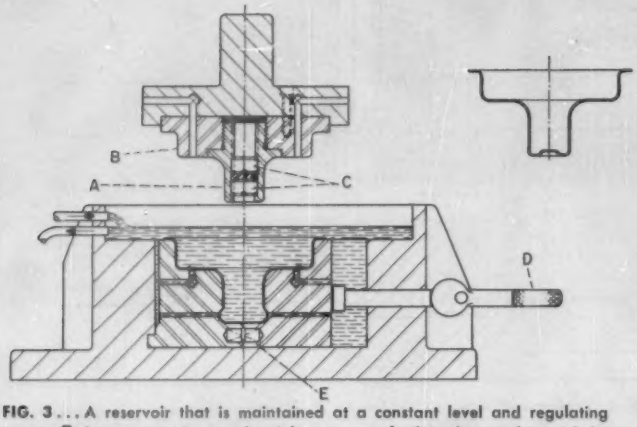


FIG. 3 . . . A reservoir that is maintained at a constant level and regulating screws C that are set to trap the right amount of oil in the punch avoid the need for carefully filling each shell with the correct amount of fluid

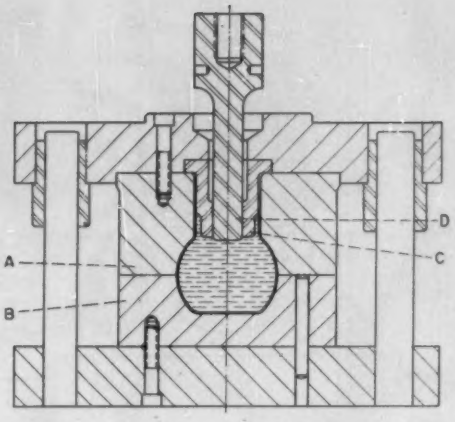


FIG. 4 . . . Metering piece C first enters the shell and forces out the excess water. Then, after members A and B have come together to form the mold, the plunger bulges the shell

mark the parting line on the work. A retaining groove is turned near the end of the screw, and pin *E* attaches the die block to the screw but permits it to be turned in either direction.

Punch *F*, made of hardened and ground tool steel, is retained in plate *G*. The head of the punch rests against a thin steel plate *H*, which serves as a "shear" plate to protect the press in case too much fluid is placed in the shell. If this occurs, the pressure build-up will cause the punch head to pierce a hole in the plate. A hardened and ground die ring *I* receives the slug punched out of the plate.

Plate *H* should be of such thickness that it will be pierced when a pressure of approximately two-thirds of the press capacity has been reached. Stop blocks are provided at *J* to prevent the punch from descending too far into the shell.

BUILT-IN RESERVOIRS

To avoid the need for carefully filling each shell with the correct amount of fluid, bulging dies are frequently designed with reservoirs, and the shell is completely submerged in the fluid as shown in Fig. 3. In addition to bulging the closed end of the shell, the die illustrated sets the flange radius as well as the radius at the point where the hub meets the body of the shell. The shell, as it appears before bulging, is shown at the right of the drawing. The bottom of the shell is indented to provide the necessary metal for the bulging operation. If the hub were drawn higher than the finished shell to provide the additional metal, the shell would not fit properly in the die.

In operation, the shell is placed in the die and is immediately filled with oil. Automatic pumps maintain the oil in the reservoir at a constant level. When punch *A* descends, it enters the shell and expands the hub by 0.010 in., to make it fit tightly and to prevent the oil from being forced upward between the punch and the walls of the hub during the bulging operation. At the same time the oil is being displaced to bulge the hub, punch *B* enters the body of the shell to set the radii and flatten the flange. Oil discharged from the body of the shell is returned through holes in the punch.

The amount of oil necessary for bulging is regulated by screws *C*. These screws must be accurately adjusted to trap the right amount of oil. If they are too high in the punch, an insufficient amount of oil will be displaced and the metal will not fill the cavity in the die. If the screws are too low in the punch the pressure will be too great and may damage the die or the press. A rubber washer prevents the oil from leaking past the screws.

When the work has been completed and the punch has returned to its up position, the shell is released by raising the handle of cam *D* and allowing springs *E* to open the die. Cam locks are preferred to screw locks when only a small movement is necessary to open and close the die, because they work faster.

AUTOMATIC METERING

When designing bulging dies where the stamping is placed under the fluid, care must be taken to provide escape holes to permit the fluid in the die to be forced back to the top of the reservoir, so that the shell can be placed in the die. Holes must also be provided to permit the surplus oil in the cavities to escape when the bulge starts to form.

When a double-action press is available, a meter-type die similar to that shown in Fig. 4 can be employed. This type of die automatically measures the correct amount of fluid in the shell, thus preventing accidents. Better quality work and more pieces per hour can be produced, because the exact amount of fluid is assured for all shells.

The die consists of upper and lower members *A* and *B*, both of which inclose the shell and form a mold to give the shell its proper shape. Other details of the die are: metering piece *C* and plunger *D*. In operation the shell is filled with fluid and is placed in the die. The press is then tripped and piece *C*

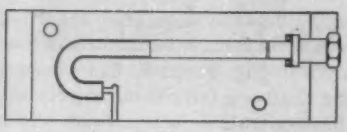


Fig. 5

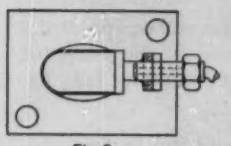
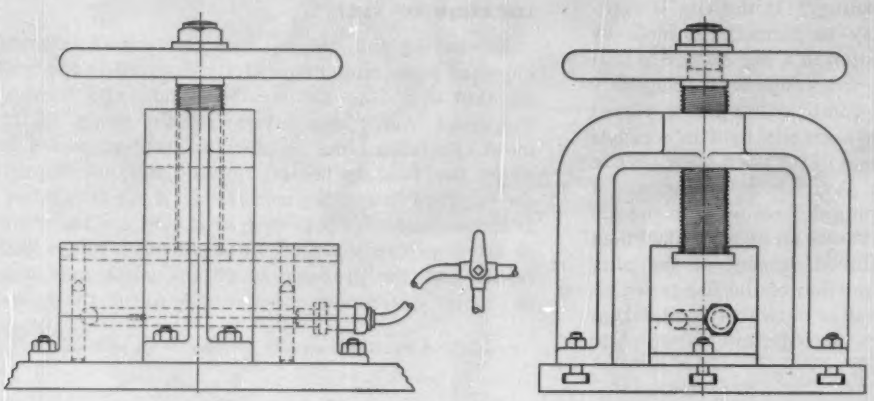
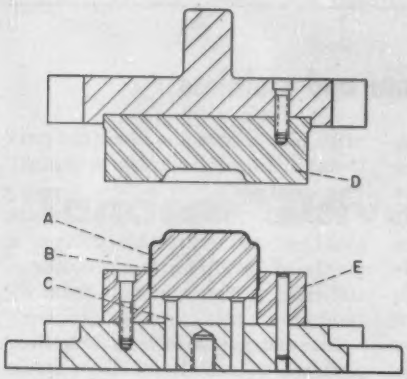


Fig. 6



FIGS. 5 AND 6... Horizontal dies of the screw-locked type are used for bulging bent tubing to a smooth contour or expanding a shell into a machined cavity. Accumulator water at 600 to 1200 psi is customarily used



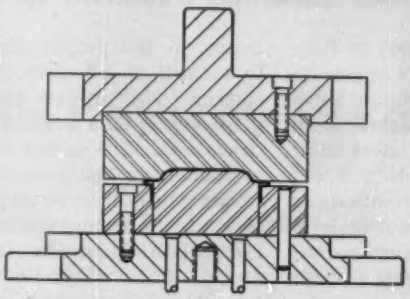


Fig. 7

FIG. 7... Heading of a previously drawn shell is done by restraining the open end by means of a ledge inside die ring *E* and applying pressure with plate *D*. The unsupported portion of the flange is bulged outward and then flattened

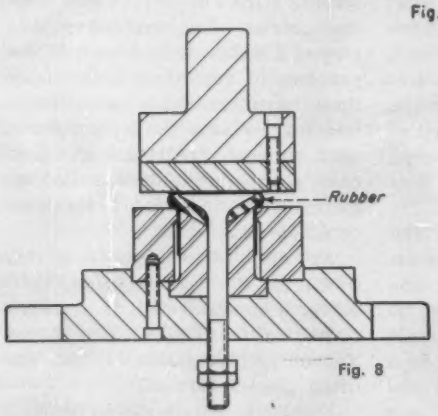


Fig. 8

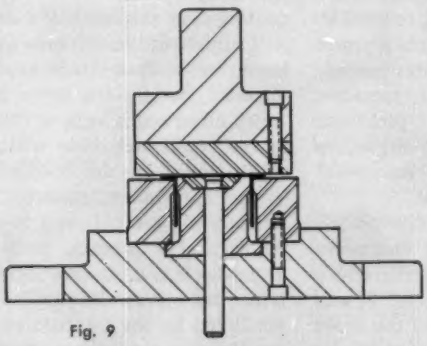


Fig. 9

FIGS. 8 AND 9... If a wide rim is to be headed on a shell, it is necessary to use two operations: (1) partial bulging with rubber, and (3) flattening

enters the shell and forces out the excess water. When this has been accomplished, and members *A* and *B* have come together to form the mold, the plunger descends.

HORIZONTAL FLUID BULGING DIES

Shells are frequently bulged or bent in horizontal dies which are opened and closed by a locking screw, as shown in Figs. 5 and 6. These dies are located on benches and are equipped with a valve control that permits them to be filled with water from city pressure, bulged or bent with accumulated pressure, and then emptied into the waste pipes. Pressures ranging from 600 to 1200 psi are required for this work. The die blocks are aligned by small guide pins. The contact surfaces of the blocks must

Cope Talks on Draw Dies XVIII . . . *continued*

be lapped perfectly smooth to prevent escape of the water. A thin film of oil is placed on the work for bending operations. No lubricant is used for bulging.

HEADING OPERATIONS

When a rim is expanded around the bottom of a shell, and the metal is flattened upon itself, the operation is known as "heading." If the rim is comparatively narrow, it may be formed complete by direct action in one operation in a die similar to that shown in Fig. 7. Shell *A*, which has been previously blanked and drawn in a combination die, is placed over plug *B*. This plug is normally held in a raised position by pins *C*, as shown in the open view. When the slide descends, plate *D* contacts the bottom of the shell and forces the plug downward into the die until the edge of the shell rests on a ledge machined inside die ring *E*. Continued descent of the plug causes the metal in that portion of the flange which extends above the die to bulge outwardly and flatten upon itself, as shown in the closed view. When plate *D* rises, plug *B* ejects the work from the die member.

If the rim is wide it must be formed in two operations, as shown in Fig. 8 and 9. The walls near the bottom of the shell are bulged outwardly with rubber in the first operation, after which the metal is flattened upon itself in the second operation.

LOCATION OF VENTS

Expanding and bulging dies that completely inclose the work must be carefully examined for pockets that may trap air or other fluids, and prevent the metal from filling out against the cavity in the mold. Suitable holes or slots must be provided to allow the fluid to escape rapidly and not impede the outward flow of the metal when it starts to bulge. If air vents are not provided, or if they are too small or are improperly placed, unsatisfactory bulges will result, and the pressure to do the work may rise to a point which may endanger the die or the press.

Part XIX of Mr. Cope's series will appear in an early number.

Boeing develops scale-inhibiting treatment for titanium and stainless

Two processes, developed in Boeing Airplane Company's engineering process unit, are helping solve problems of scale removal from titanium and stainless steel after heat-treatment. They do this (1) by inhibiting scale formation, or (2) by converting normal scale to a form which will later permit more convenient removal. Patents have been applied for.

Most modern titanium heat-treatment is done at 1100 to 1400 F, and the resulting scale is a thick gray-blue complex oxide coating which may also contain nitrides. All that conventional picklings seemed to do, Boeing engineers found, was to dissolve the metal out from under the scale.

The first pre-anneal coating tried by Boeing process unit engineers was a simple aqueous mixture of a base and an oxidizing agent. It was found that this converted the scale so that it could be removed in a nitric-hydrofluoric acid solution. The pickled metal surface, however, was discolored and etched, but it was a beginning. Therefore a systematic program was undertaken to isolate the most satisfactory coating.

It was finally found that certain carbonates combine with some nitrates, in the proper proportions, to furnish an effective crystalline coating. The nitrates present act as oxidizers and tend to convert the normal scale oxides into oxides of higher oxygen content or different crystalline structure. TiO_2 in rutile form constitutes most of the scale in the moderate temperature range where most heat-treatment is carried out. The oxidizing agent present in the pre-coating may change this rutile to a still higher oxide or perhaps a different crystalline structure of the dioxide. Boeing engineers have at times observed a yellow coloration in the converted scale which they think might be the trioxide.

The carbonates present in the pre-coating are believed to convert the normal scale oxides or the higher oxides into a titanate form which is not tenacious. The overall scale produced by the mixture may be a combination of higher oxides and titanates.

The new scale, produced by the coating and the heat treatment, appears to have a different coefficient of expansion from the metal surface; on cooling, a portion of it cracks and can be removed with a little gentle rubbing. That which remains can be removed by a single brief pickle in a modified conventional nitric-hydrofluoric acid pickling solution.

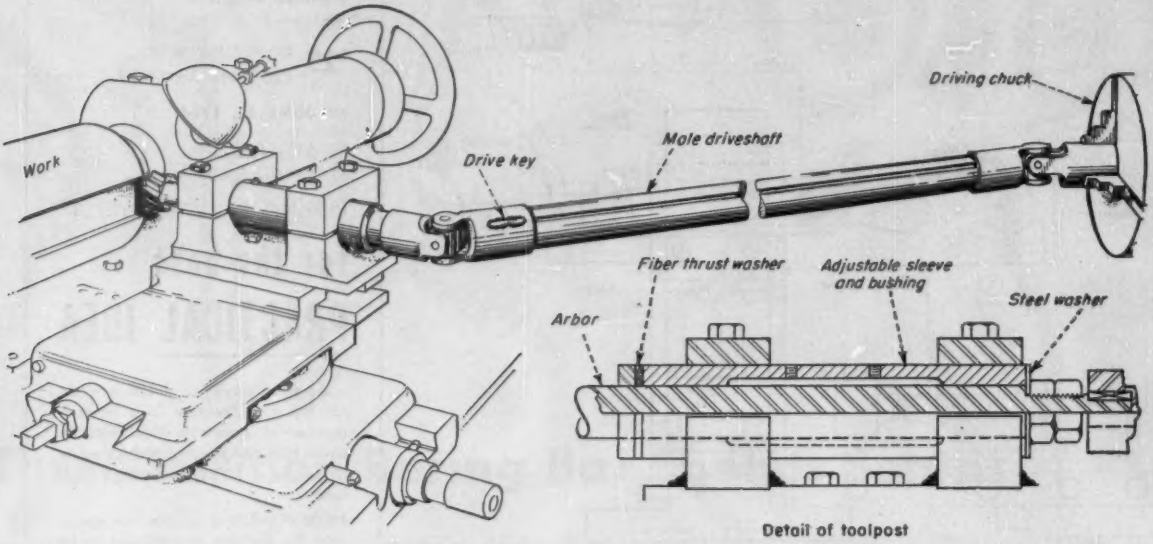
Normal titanium scale resists pickling; yet with this process a pickle of less than ten minutes is sufficient to remove scale from titanium.

Descaling is also a troublesome problem on certain stainless steels such as AISI 310 or 17-7 PH. Boeing process unit engineers employed a different approach to the problem of removing scales from these stainless steels after heat-treating, because the temperatures used were so great that the pre-coat used on titanium boiled or melted from the surface before they could do any good.

An attempt was made to lay down on the surface some inert silicon compound such as a silicate or plain silica. The silicates did not appear to give much benefit, and often glasses formed.

Finally a certain silicon-bearing substance was found which decomposes in the furnace and deposits a coating of finely divided silica. The barrier of silica, which can be rinsed or brushed off after heat treating, markedly inhibits oxidation of the metal's surface and it saves processing time.

Practical Ideas . . .



Detail of toolpost

"Tandem" Drive Mills Keyway In Large Shaft

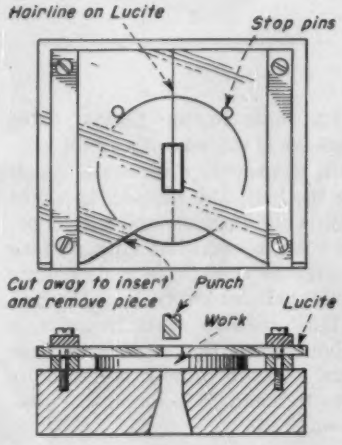
The setup shown solved a very difficult problem we came across recently. We were making a replacement shaft for a large upset forging machine, and could just handle the turning of the 8⅝-in.-OD shaft 12 ft long. However, when it came to milling the keyway in the end of the shaft, we were forced to improvise, because our equipment wasn't large enough for the job.

To make the keyway, we mounted a spindle with a milling cutter in the lathe compound. Then we connected a driveshaft from this cutter to the chuck of a nearby lathe, which furnished the power to turn the cutter.

The basic unit of the setup is our regular boring bar holder for the lathe. Instead of the boring bar, though, we fitted a bronze sleeve in the holder. Two universal joints completed the connection.

A fiber washer took the thrust of the milling cutter, and two locknuts on the other end of the spindle kept the arbor properly spaced. The traverse of the lathe furnished the feed for the cutter.

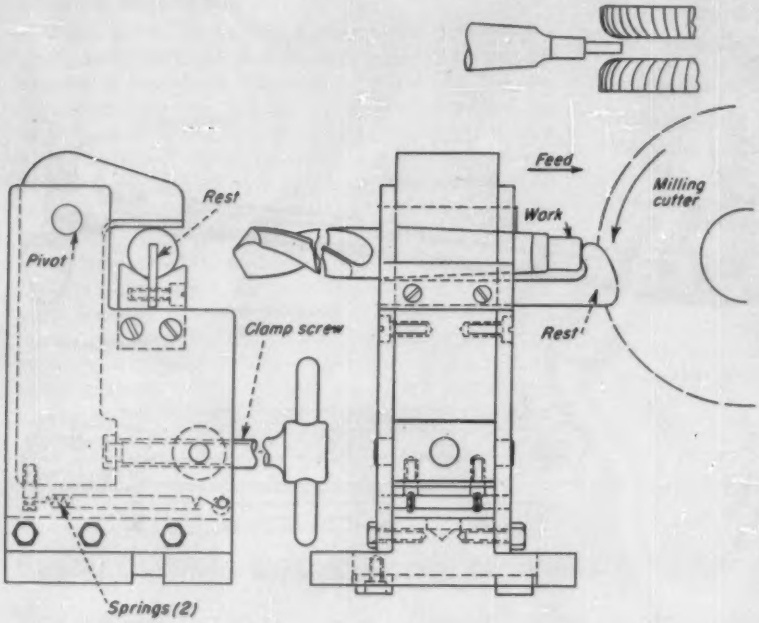
To allow for "stretch," we made the driveshaft of two pieces. One piece was 1¼-in. extra heavy pipe, in one side of which a key was inserted and welded in place. The other half of the driveshaft was solid, with a keyway machined to take the key in the pipe. When the cutter moved away from the driving chuck, the keyway allowed for the extra distance needed. *John Emrich, Capitol Mfg & Supply Co, Columbus, Ohio*



Lucite Stripper For Locating

We had to blank a number of nameplates which had already been printed, but could not be located from any edge of the work. To locate the plates from the writing on them, we used a Lucite stripper with a scribe line on it. Two small pieces of steel reinforced the plate, which has been used for thousands of pieces with no sign of wear.

The work is inserted under the stripper and pushed against two stop pins. Then it is rotated to line up with the scribed line. *V Stuart, Jersey City, NJ*

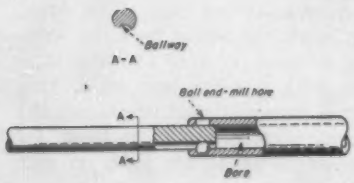


Milling Fixture For Flats On Drills

We often have to mill the two flats on the end of drills, reamers, and similar tools. We used to do this work with a dividing head, but found this method too slow, so we built the pivoted-clamp fixture shown here.

The work is held between a shallow V-block and a clamp (both tapered to match the taper on the tool shank). The clamp pivots into place when the clamp screw is tightened. A narrow, fixed rest locates the work for correct depth.

A pair of milling cutters with the proper shape completes the cut in one pass. With this fixture in use, the dividing head is free for more appropriate uses. *Edward Schmidt, West Berlin, Germany*



Ball-Bearing Telescoping Drive

This simple drive provides an inexpensive but effective means for making a telescopic driveshaft.

The hole in the hollow drive member is milled with a ball end-mill, to provide a spherical recess for the ball. The keyway is milled with a similarly shaped cutter, being sure to make the channel long enough so that there is no chance of the ball becoming disengaged.

This method will produce a drive similar to a sliding key (or even a coarse spline), and is quite easy to make. *M L Parsons, Tullahoma, Tenn*

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JUDGES—A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, select the best Practical Idea. If at any time their votes result in a tie, $25 will be paid to each and every co-winner. Decision of the readers will be final in each case.

REQUIREMENTS—Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer or author—every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product—in terms of its usefulness to them.

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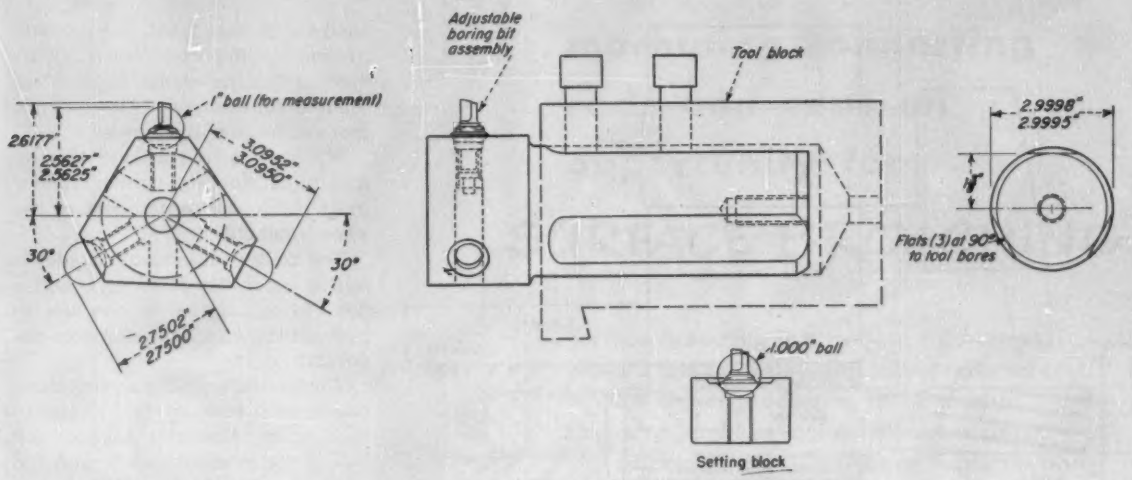


Three-Position Boring Bar Speeds Setups

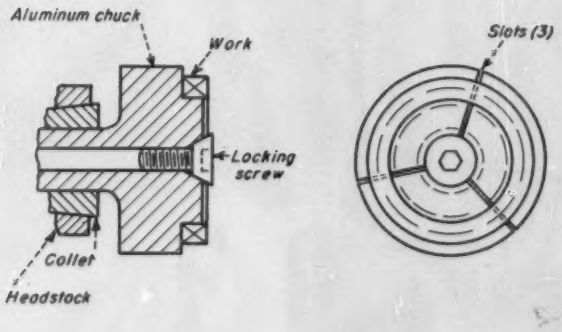
Setup changes on a 12-in. eight-spindle Bullard Mult-Au-Matic machining gear blanks are simplified by a three-position boring bar for the finishing station. By simply turning the bar in its supporting block, the machine can be set to finish-bore blanks of three size ranges.

The bar has three positions for mounting a special precision boring bit assembly. Each position is carefully machined to locate the cutting edge of the carbide-tipped boring bit at a known distance from the center of the bar, thus permitting rapid setups.

In the toolroom the bit is positioned in its presetting block to gage block dimensions. Then the adjustable toolbit assembly is locked in the bar. Vernier adjustment of the holder permits resetting the bit to suit tolerances after a first trial cut has been taken.

When a bit becomes dull, the tool bit assembly is removed from the bar and returned to the toolroom. Meanwhile, another holder with a sharp bit is mounted in the boring bar so work can proceed. Usually only one size correction is necessary after a bit has been changed. *Larry Harrington, tool engineer, Clark Equipment Co, Jackson, Mich*

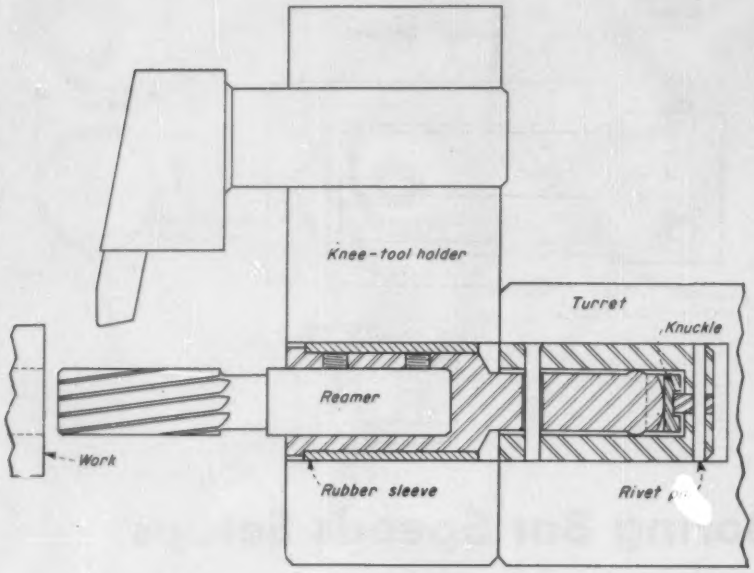
Slotted Aluminum Step-Chuck Holds Small Rings



An inexpensive chuck for holding small rings (to 3½-in. diameter) can be made in the manner shown here. The chuck body is made of aluminum, with a drilled hole, countersunk at 30°. The body of the chuck is then slotted at three places 120° apart, and capscrew is made.

To hold a given piece, a step is turned to the required ID of the part. Then the part is put on the step, and a slight turn of the capscrew grips the work.

For longer runs, a similar chuck can be made, but with a drawbar like a collet. This is a little more expensive, but worthwhile if production is in sufficient quantity. *Henry H Ramm, Columbia, Conn*



Floating Reamer-Holder For Knee Tools

When tooling automatics with a square turret instead of the hex turret, nearly every job presented the same problem: How could we get drills and reamers, as well as the needed outside turning tools, into the four stations of the turret? Drills and boring bars combine easily with knee tools, but reamers present a different problem. Commercial floating reamer holders are too long for the space between knee toolholder and workpiece.

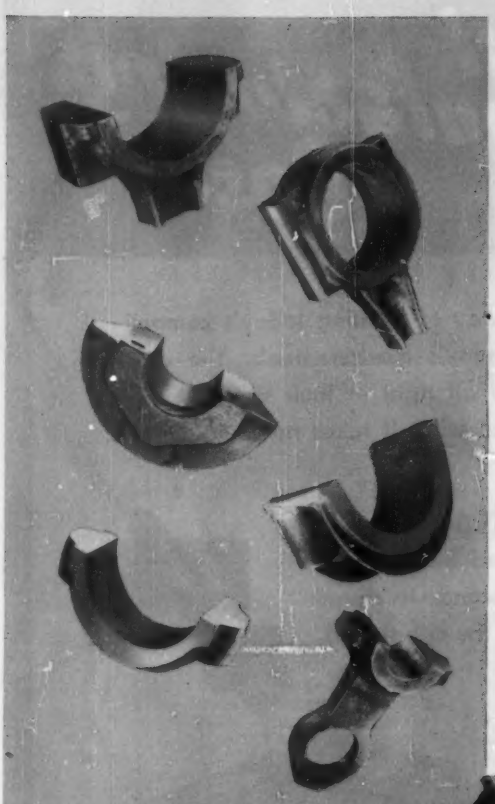
We have gotten around this by making a floating reamer holder to fit inside the center bore of the knee toolholder.

The body of the reamer holder is milled across its blind end, and a flat key is inserted in the slot to prevent the knuckle piece from revolving.

The knuckle piece has two slots, one in each face, at right angles to each other. One slot engages the tail of the reamer socket, and the other engages the key. These slots allow a universal movement of the tail of the reamer socket, while preventing it from turning.

A pin in the body of the holder only works during the return stroke, keeping the reamer in place in the body. The soft rubber sleeve between socket and bore of the holder keeps the reamer close to the center of the hole, but allows it to float and find the true center when the tool enters the work. *D Moore, Victoria, Australia*

SHOP-MADE "MUSIC STANDS" are used in an English factory to hold blueprints in the toolroom. This method makes it easy for the operator to read the print, and prevents tearing of prints because of frequent folding and unfolding



machining connecting rods and caps an opportunity for

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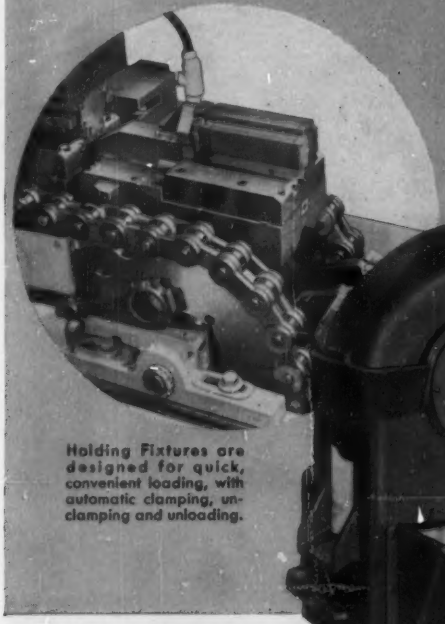

Holding Fixtures are designed for quick, convenient loading, with automatic clamping, unclamping and unloading.

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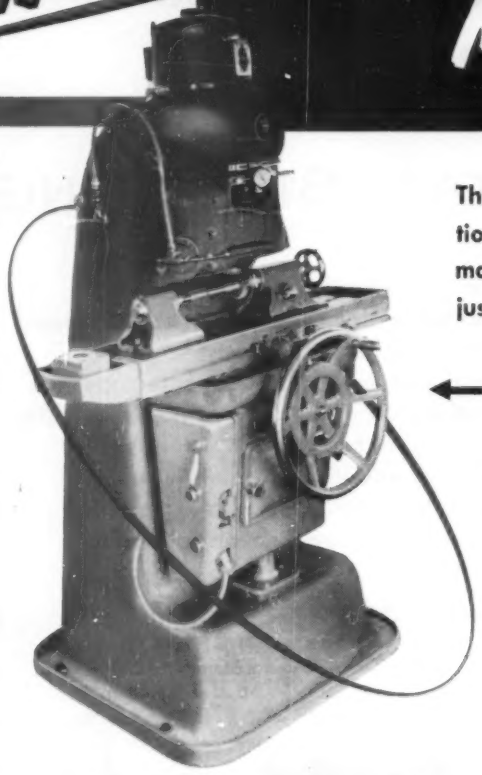
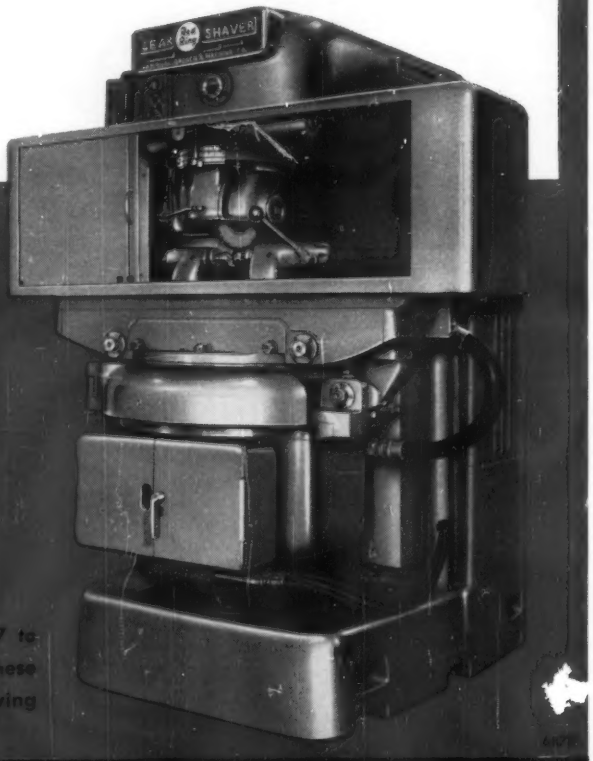


The one sure way of meeting today's competition is with today's machine tools. The older machines were all right in their day but they just haven't got what it takes now.

← **For instance,** it took this old Red Ring Model GCC 60 seconds to shave a gear like the one shown. →



Model GCU today finishes that same gear in just 16 seconds—and to much closer tolerances, too.

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Limits and Fits for Cylindrical Parts... X

This proposal for an American Standard will be published by the American Society of Mechanical Engineers after acceptance

table 8 . . . Standard Tolerances

All values in inches. Data in bold face are in accordance with ABC agreements.

Nominal Size Range Inches Over	To	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	Grade 9	Grade 10	Grade 11	Grade 12	Grade 13
0.04–	0.12	**0.00015**	**0.00020**	**0.00025**	**0.0004**	**0.0006**	**0.0010**	**0.0016**	**0.0025**	**0.004**	**0.006**
0.12–	0.24	**0.00015**	**0.00020**	**0.0003**	**0.0005**	**0.0007**	**0.0012**	**0.0018**	**0.0030**	**0.005**	**0.007**
0.24–	0.40	**0.00015**	**0.00025**	**0.0004**	**0.0006**	**0.0009**	**0.0014**	**0.0022**	**0.0035**	**0.006**	**0.009**
0.40–	0.71	**0.0002**	**0.0003**	**0.0004**	**0.0007**	**0.0010**	**0.0016**	**0.0028**	**0.0040**	**0.007**	**0.010**
0.71–	1.19	**0.00025**	**0.0004**	**0.0005**	**0.0008**	**0.0012**	**0.0020**	**0.0035**	**0.0050**	**0.008**	**0.012**
1.19–	1.97	**0.0003**	**0.0004**	**0.0006**	**0.0010**	**0.0016**	**0.0025**	**0.0040**	**0.006**	**0.010**	**0.016**
1.97–	3.15	**0.0003**	**0.0005**	**0.0007**	**0.0012**	**0.0018**	**0.0030**	**0.0045**	**0.007**	**0.012**	**0.018**
3.15–	4.73	**0.0004**	**0.0006**	**0.0009**	**0.0014**	**0.0022**	**0.0035**	**0.005**	**0.009**	**0.014**	**0.022**
4.73–	7.09	**0.0005**	**0.0007**	**0.0010**	**0.0016**	**0.0025**	**0.0040**	**0.006**	**0.010**	**0.016**	**0.025**
7.09–	9.85	**0.0006**	**0.0008**	**0.0012**	**0.0018**	**0.0028**	**0.0045**	**0.007**	**0.012**	**0.018**	**0.028**
9.85–	12.41	**0.0006**	**0.0009**	**0.0012**	**0.0020**	**0.0030**	**0.0050**	**0.008**	**0.012**	**0.020**	**0.030**
12.41–	15.75	**0.0007**	**0.0010**	**0.0014**	**0.0022**	**0.0035**	**0.006**	**0.009**	**0.014**	**0.022**	**0.035**
15.75–	19.69	**0.0008**	**0.0010**	**0.0016**	**0.0025**	**0.004**	**0.006**	**0.010**	**0.016**	**0.025**	**0.040**
19.69–	30.09	0.0009	0.0012	0.0020	0.003	0.005	0.008	0.012	0.020	0.030	0.050
30.09–	41.49	0.0010	0.0016	0.0025	0.004	0.006	0.010	0.016	0.025	0.040	0.060
41.49–	56.19	0.0012	0.0020	0.003	0.005	0.008	0.012	0.020	0.030	0.050	0.080
56.19–	76.39	0.0016	0.0025	0.004	0.006	0.010	0.016	0.025	0.040	0.060	0.100
76.39–	100.9	0.0020	0.003	0.005	0.008	0.012	0.020	0.030	0.050	0.080	0.125
100.9–	131.9	0.0025	0.004	0.006	0.010	0.016	0.025	0.040	0.060	0.100	0.160
131.9–	171.9	0.003	0.005	0.008	0.012	0.020	0.030	0.050	0.080	0.125	0.200
171.9–	200	0.004	0.006	0.010	0.016	0.025	0.040	0.060	0.100	0.160	0.250

Designation of Standard Fits. Standard fits are designated by means of the symbols given below to facilitate reference to classes of fit for educational purposes. These symbols are not intended to be shown on manufacturing drawings; instead, sizes should be specified on drawings.

The letter symbols used are as follows:

RC—Running or Sliding Fit
LC—Locational Clearance Fit
LT—Transition Fit
LN—Locational Interference Fit
FN—Force or Shrink Fit

These letter symbols are used in conjunction with numbers representing the class of fit; thus "FN 4" represents a Class 4, force fit.

Each of these symbols (two letters and a number) represent a complete fit, for which the minimum and maximum clearance or interference, and the limits of size for the mating parts, are given directly in the tables.

Description of Fits

RUNNING AND SLIDING FITS. Running and sliding fits, for which limits of clearance are given in Table 3, represent a special type of clearance fit. These are intended to provide a similar running performance, with suitable lubrication allowance, throughout the range of sizes. The clearances for the first two classes, used chiefly as slide fits, increase more slowly with diameter than the other classes, so that accurate location is maintained even at the expense of free relative motion.

These fits may be described briefly as follows:

RC 1—*Close sliding fits* are intended for the accurate location of parts which must assemble without perceptible play.

RC 2—*Sliding fits* are intended for accurate location, but with greater maximum clearance than class RC 1. Parts made to this fit move and turn easily but are not intended to run freely, and in the larger sizes may seize with small temperature changes.

RC 3—*Precision running fits* are about the closest fits which can be expected to run freely, and are intended for precision work at slow speeds and light journal pressures, but are not suitable where appreciable temperature differences are likely to be encountered.

RC 4—*Close running fits* are intended chiefly for running fits on accurate machinery with moderate surface speeds and journal pressures, where accurate location and minimum play is desired.

RC 5 and RC 6—*Medium running fits* are intended for higher running speeds, or heavy journal pressures, or both.

RC 7—*Free running fits* are intended for use where accuracy is not essential, or where large temperature variations are likely to be encountered, or both conditions.

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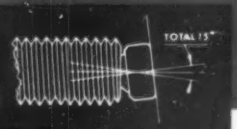
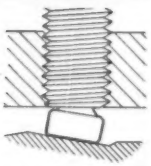
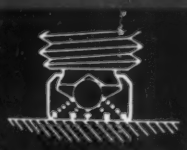


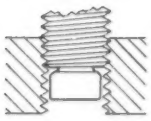
Ball-bearing construction insures frictionless, *automatic* angle adjustment and rotation; pad swivels freely in *all* directions up to 7½° from the centerline!



Pad seats firmly on work surface within angular range!



Force distributed equally to pad face. Conical seat distributes force equally in all directions; insures easy alignment in angular applications; greater freedom of motion.



Pad inserts from top of threaded hole or from bottom for easy installation!

Large pad area. Pad is machined from the solid, not counterbored or relieved; has greater strength plus freedom from distortion!

NO MORE EXPENSIVE, CUSTOM-MADE SWIVEL PADS . . . 17 size variations; ¼" O.D. up. N.C. threads; class 2 fit.

LOW COST... Saves hundreds of dollars annually in toolmaker's time!

NO MARRING... Rotation of pad ceases at first touch against the work! Soft seat saves surfaces!

HEX SOCKET HEAD... for easy hex key adjustments!

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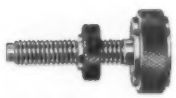
MONEY-SAVING TOOLING SPECIALTIES FOR EVERY REQUIREMENT!



TORQUE THUMB SCREWS— Apply accurate, controlled end pressures; eliminate distortion to the workpiece. 4 models; 19 sizes!

VLIER SPRING PLUNGERS— For use wherever accurate, positive spring loads are needed! 4 models; 40 sizes!

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VLIER FIXTURE KEYS— New 5-Way Key fits every standard mill table slot. 3-Way model also available.

Write for your complete catalog of Vlier products today! It's free!

Limits and Fits for Cylindrical Parts... XI

RC 8 and RC 9—*Loose running fits* are intended for use where materials such as cold-rolled shafting and tubing, made to commercial tolerances, are involved.

LOCATIONAL FITS. Locational fits are fits intended to determine only the location of the mating parts; they may provide rigid or accurate location, as with interference fits, or provide some freedom of location, as with clearance fits. Accordingly they are divided into three groups: clearance fits, transition fits, and interference fits.

These are more fully described as follows:

LC—*Locational clearance fits* are intended for parts which are normally stationary, but which can be freely assembled or disassembled. They run from snug fits for parts requiring accuracy of location, through the medium clearance fits for parts such as spigots, to the looser fastener fits where freedom of assembly is of prime importance. (See Table 4.)

LT—*Transition fits* are a compromise between clearance and interference fits, for application where accuracy of location is important, but either a small amount of clearance or interference is permissible. (See Table 5.)

LN—*Location interference fits* are used where accuracy of location is of prime importance, and for parts requiring rigidity and alignment with no special requirements for bore pressure. Such fits are not intended for parts designed to transmit frictional loads from one part to another by virtue of the tightness of fit, as these conditions are covered by force fits. (See Table 6.)

FORCE FITS. Force or shrink fits constitute a special type of interference fit, normally characterized by maintenance of constant bore pressures throughout the range of sizes. The interference therefore varies almost directly with diameter, and the difference between its minimum and maximum value is small, to maintain the resulting pressures within reasonable limits. (See Table 7.)

These fits may be described briefly as follows:

FN 1—*Light drive fits* are those requiring light assembly pressures, and produce more or less permanent assemblies. They are suitable for thin sections or long fits, or in cast-iron external members.

FN 2—*Medium drive fits* are suitable for ordinary steel parts, or for shrink fits on light sections. They are about the tightest fits that can be used with high-grade cast-iron external members.

FN 3—*Heavy drive fits* are suitable for heavier steel parts or for shrink fits in medium sections.

FN 4 and FN 5—*Force fits* are suitable for parts which can be highly stressed, or for shrink fits where the heavy pressing forces required are impractical.

Standard Tolerances

The series of standard tolerances shown in Table 8 are so arranged that for any one grade they represent approximately similar production difficulties throughout the range of sizes. The table provides a suitable range from which appropriate tolerances for holes and shafts can be selected. This enables the use of standard gages. These tolerances have been used in arranging the fits given in Tables 3 to 7.

Modified Standard Fits

Fits having the same limits of clearance or interference as those shown in Tables 3 to 7 may sometimes have to be produced by using holes or shafts other than those shown in the tables. This may be accomplished by using one of the following:

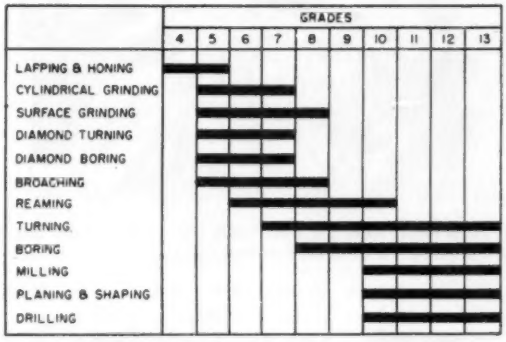


FIG. 6 . . . Machining processes that can be expected to produce work within tolerances given in proposed standard

(a) BILATERAL HOLES (Symbol B)—This will result in non-standard holes and shafts.

(b) A BASIC SHAFT SYSTEM (Symbol S)—This will result in non-standard holes and shafts.

Bilateral Hole Fits (Symbol B). The common case is where holes are produced with fixed tools, such as drills or reamers; to provide a longer wear life for such tools a bilateral tolerance is desired.

The symbols used for these fits are identical with standard fits except that they are followed by the letter "B." Thus "LC 4B" is a clearance locational fit, Class 4, except that it is produced with a bilateral hole.

The limits of clearance or interference are identical with those shown in Tables 3 to 7 for the corresponding fits.

The hole tolerance is changed so that the plus limit is that for one grade finer than the value shown in the tables, the minus limit equals the amount by which the plus limit was lowered, and the shaft limits are both lowered by the same amount as the lower limit of size of the hole. The finer grade of tolerance can be found in Table 8.

Basic Shaft Fits (*Symbol S*). For these fits the maximum size of the shaft is basic. The limits of clearance or interference are identical with those shown in Tables 3 to 7 for the corresponding fits. The symbols used for these fits are identical with those used for standard fits except that they are followed by the letter "S." Thus "LC 4S" is a clearance locational fit, Class 4, except that it is produced on a basic shaft basis.

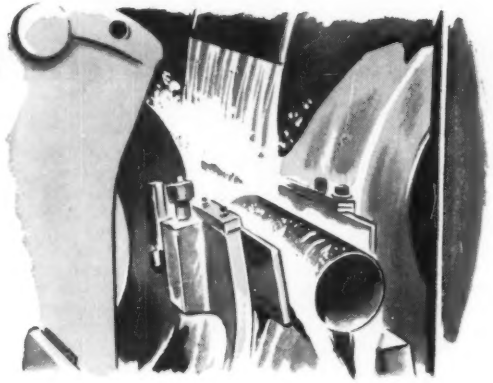
The limits for hole and shaft as given in Tables 3 to 7 are increased for clearance fits, or decreased for transition or interference fits, by the value of the upper shaft limit; that is, by the amount required to change the maximum shaft to the basic size.

Machining Processes

To indicate the machining processes which may normally be expected to produce work within the tolerances indicated by the grades given in this Standard, Fig. 6 has been provided. This information is intended merely as a guide.

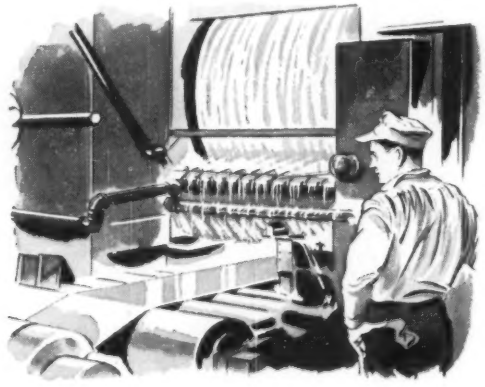
New S.E.C.O. is Tops For These Operations

CUTTING WITH NEW S.E.C.O. Tools stay cool—require less frequent grinding. Finishes are uniformly good.



GRINDING WITH NEW S.E.C.O. Surface finishes are good. Loading and glazing of wheel are reduced—wheel life is prolonged.

WASHING WITH NEW S.E.C.O. Thorough removal of grease and dirt provides clean surfaces for smooth, long-lasting finishes.



ROLLING WITH NEW S.E.C.O. Rolls stay clean. You get maximum reductions and low power consumption.

New Sunoco Emulsifying Cutting Oil increases production, cuts operating costs. Its high machining efficiency permits uniformly good finishes, prolongs tool life. Its high detergency and purity keep tools, parts and machines clean. Its excellent mixing qualities permit its use in cold, hard or hot water. Test New S.E.C.O. in your own plant. For more information, call your nearest Sun office or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. AM-8.

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Plug Constants for Checking Dovetails

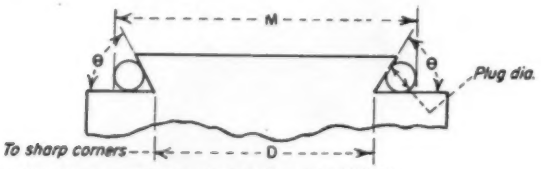
DONALD SWEET, tool engineer

To save time and work when measuring dovetails, this table is calculated for five common plug diameters, seven common even angles, and five different arrangements of dovetail and plug.

ONE END—ACUTE ANGLE:

$$X = \frac{D}{2} + \frac{D}{2 \text{ Sin } \Theta} + \frac{D}{2 \text{ Tan } \Theta}$$

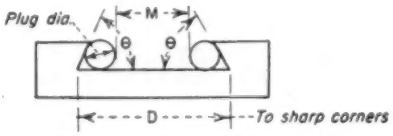
If angle Θ and the plug dia are known, the dimension X can be read directly in the table as indicated.



TWO ENDS—ACUTE ANGLES: (OUTSIDE)

$$2X = D + \frac{D}{\text{Sin } \Theta} + \frac{D}{\text{Tan } \Theta}$$

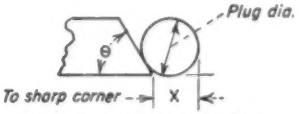
After you find 2X, apply the equation M = D + 2X (2X is read directly in the table) to get the measurement required.



TWO ENDS—ACUTE ANGLES: (INSIDE)

$$2X = D + \frac{D}{\text{Sin } \Theta} + \frac{D}{\text{Tan } \Theta}$$

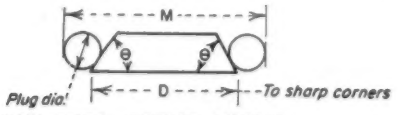
This is practically the same case as above, read from the same section of the table, but with the equation, M = D –2X, applied.



ONE END—OBTUSE ANGLE:

$$X = \frac{D}{2} + \frac{D}{2 \text{ Sin } \Theta} - \frac{D}{2 \text{ Tan } \Theta}$$

Again the value X can be read directly in the table.



TWO ENDS—OBTUSE ANGLES:

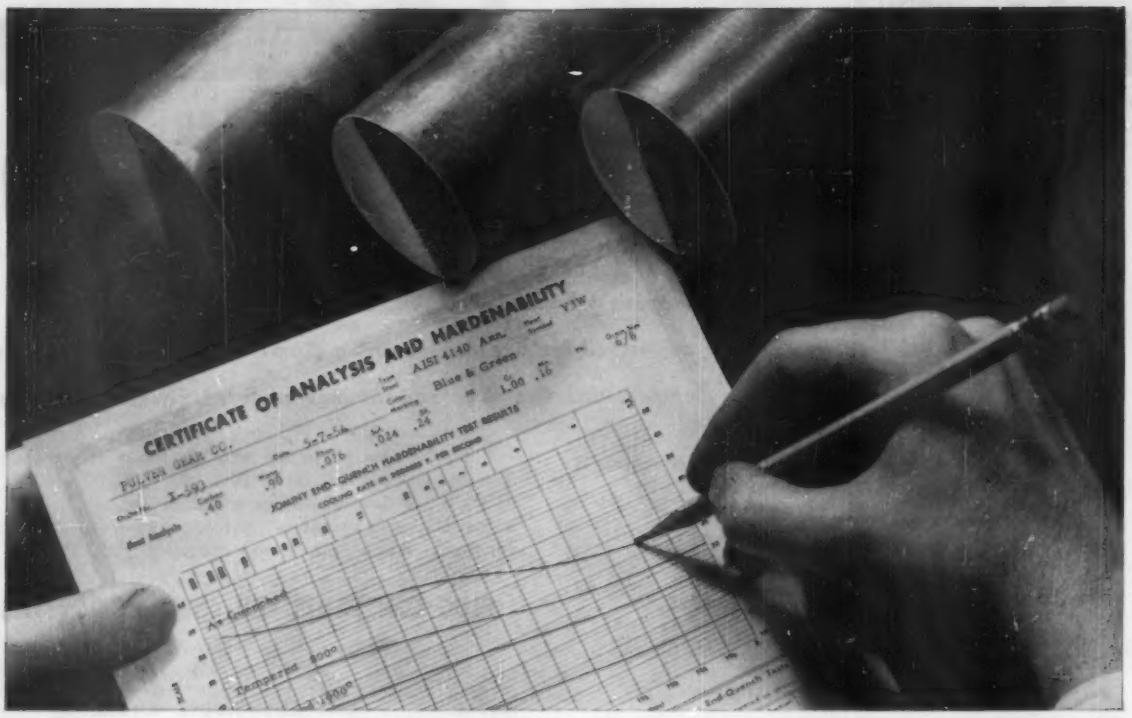
$$2X = D + \frac{D}{\text{Sin } \Theta} - \frac{D}{\text{Tan } \Theta}$$

The values for 2X in the table are just double those for X in the last example. M = D + 2X

When the dovetail angles are those indicated, little or no calculating is necessary. For odd angles, just apply the equations, which require only simple trigonometry.

PLUG CONSTANTS FOR CHECKING DOVETAIL

	Plug dia, in.				
	1/4	5/16	3/8	7/16	1/2
ANGLE,°	**ONE END—ACUTE ANGLE, X**				
30	0.59150	0.73937	0.88725	1.0351	1.1830
35	0.52145	0.65181	0.78218	0.91254	1.0429
40	0.46843	0.58553	0.70264	0.81974	0.93685
45	0.42678	0.53347	0.64016	0.74686	0.85355
50	0.39305	0.49131	0.58858	0.68784	0.78610
55	0.36510	0.45637	0.54765	0.63892	0.73020
60	0.34150	0.42688	0.51225	0.59762	0.68300
	TWO ENDS—ACUTE ANGLES, 2X				
30	1.18300	1.47874	1.77450	2.0702	2.3660
35	1.04290	1.30362	1.56436	1.82508	2.0858
40	0.93686	1.07106	1.40528	1.63948	1.87370
45	0.95356	1.06694	1.28032	1.49372	1.70710
50	0.78610	0.98262	1.17716	1.37568	1.57320
55	0.73020	0.91274	1.09530	1.27784	1.46040
60	0.68300	0.85376	1.02450	1.19524	1.36600
	ONE END—OBTUSE ANGLE, X				
30	0.15848	0.19809	0.23771	0.27733	0.31695
35	0.16440	0.20550	0.24660	0.28770	0.32880
40	0.17048	0.21309	0.25571	0.29833	0.34095
45	0.17680	0.22100	0.26520	0.30940	0.35360
50	0.18330	0.22913	0.27495	0.32077	0.36660
55	0.19008	0.23759	0.28511	0.33263	0.38015
60	0.19715	0.24644	0.29573	0.34501	0.39430
	TWO ENDS—OBTUSE ANGLES, 2X				
30	0.31696	0.39618	0.47542	0.55466	0.63390
35	0.32880	0.41100	0.49320	0.57540	0.65760
40	0.34086	0.42618	0.51142	0.59666	0.68190
45	0.35360	0.44200	0.53040	0.61880	0.70720
50	0.36660	0.45826	0.54990	0.64154	0.73320
55	0.38016	0.47518	0.57022	0.66526	0.76030
60	0.39430	0.49288	0.59146	0.69002	0.78860



Steel user drops own tests

relies on pre-tested Ryerson alloys

A manufacturer reports that it was standard practice with his company to run a pilot hardenability test on all alloys, regardless of source. But after checking their results over a period of time against Ryerson Certificates of Analysis and Hardenability, they decided that our alloy steel and our Certificates were so completely reliable that the pilot run could be discontinued. The result: a definite saving in time and money.

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You don't have to run analysis or heat treatment response tests on Ryerson Certified Alloys. You save time and money because these tests are run and recorded for you as a part of the exclusive Ryerson 8-step quality control plan.

Starting with the careful selection and identification of every heat carried in Ryerson stock, this plan assures you of quality steel—steel of known analysis and known performance. It means that tested alloys, racked separately by heats, are accurately prepared to your specification and shipped to you with test data to confirm quality and guide heat treatment.

Yes, you save time and money with Ryerson Certified Alloys . . . yet you pay no more. To get these dependable controlled-quality steels promply, call your nearby Ryerson plant.

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Principal products in stock: bars, structurals, plates, sheets, tubing, alloy and stainless steel, reinforcing steel, etc., also machinery and tools.

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Talking Shop . . .

Tell People

ROLLWAY BEARING, Syracuse, has no house organ. But C C Hilchie, employment manager, has substituted another idea that works. He posts on plant bulletin boards a picture and biography of each man who retires, emphasizing high points of what he has done for the firm. Response has been excellent, particularly because the posting is done *before* the man retires. Thus his friends have a chance to convey their regards—and in some cases to learn a bit about his private life for the first time.

Long Memory

RECENTLY the president of Star Tool & Die Co, Detroit, recalled an article he had once read in *American Machinist* about Johnson drive gears and authored by the inventor. He seemed to remember that it had been published only a few years back, but in checking it at the University of Michigan Library, he found that the actual date of publication was April 21, 1905. We are pleased both by the fact that the article was so well done that even in recollection it retained its youth, and also in the fact that recalling something after 49 years completely confounds the theory propagated by most strip cartoonists, mainly that the reader forgets everything in a two-year span.

Quick Trip

TEMCO AIRCRAFT CORP, Dallas, is returning cracked or broken milling cutters to operation the same day they are damaged. Special fixtures, correct welding equipment, and a skilled welder on the job have saved thousands of dollars, particularly when one cutter of a matched pair is spoiled. The fixture is a disk of surface-ground boiler plate to which the cutter pieces are held with C-clamps. Then they are tacked in two places with the arc and a Eutectic 680 electrode (high-alloy tool steel). A deep groove is ground on each side along the crack with a ¼x7-in. wheel. For preheating, the cutter is placed in a fixture made of two steel rings cut from 10-in. ID pipe, each with outside crosspieces. Nuts are welded at four points outside the rings, so they can be pulled together by ½x4 in. bolts. Four smaller bolts pass through nuts welded to the crossarms on each side, so the cutter can be firmly sandwiched within. Preheat is to about 700F, then the crack or break is welded (with the cutter still in the fixture) with Eutectic 680. Between tacks, work is held to temperature with a No. 7 tip on an oxy-acetylene torch. To prevent further cracks, welding is done from the hub out, on both sides progressively, with the arc at the center of the groove. As soon as a tack is made, the torch flame is applied. For cracks or breaks across, the welding is "balanced" — both sides are worked out at the same rate. Welding takes about 30 min. for all operations on a 10-in. cutter. Then the cutter is normalized and placed on edge in a box to cool, after which the weld is ground flush.

Biggest Employer

AIRCRAFT production is currently requiring 823,000 men, as compared with 786,000 on automobiles, making the aircraft industry No. 1, according to the U S Bureau of Labor Statistics. Contributing, of course, is the current drop in automotive employment. Aircraft was the largest user of manufacturing manpower during World War II, but in 1946 it dropped to 16th.

Unshipped Weekend

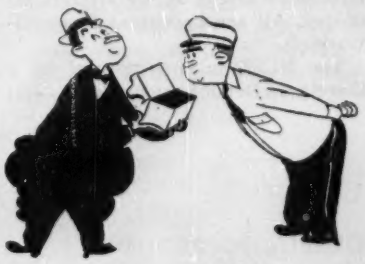
TIMKEN ROLLER BEARING COMPANY outlawed weekend shipping by truck a year ago, since has made only nine emergency weekend shipments. Truckers and the public have welcomed this reduction in weekend driving hazards.

Drifter

IN MODERNIZING our offices, we came across a 1951 letter from Howard Hoyt, chief of police in Kalamazoo, Mich. We had sent a check for a *Practical Idea* to a man in Kalamazoo who was obviously a crackerjack toolmaker. He also was, it seemed, a crackerjack check forger, and his check had to follow him from Michigan City, Ind, where he'd been in jail, to Kazoo and on to Jackson, Mich, where he was then serving 2½-5 years for the same crime. Said Chief Hoyt, "He is one of those unusual individuals we occasionally come in contact with who seem to prefer to pass bad checks than to lend his excellent mechanical talents toward making an honest living . . . I understand a number of other authorities are waiting for him . . ."

Thievery

PILFERING of parts, tools and materials is usually the work of the experienced employee who knows his way around, and who is smart enough that the boss respects him, according to Pinkerton men. Catching a petty thief is tough, because detectives usually have no right to search a man, and if this right is granted in the original employment contract, morale is noticeably reduced. Recent case studies: An operator carried an unusually large



thermos bottle, but was seen buying coffee. Turned out he was using the bottle to carry home sparkplugs for a thriving cut-rate business . . . Deliveries were clogging a receiving platform, so it had become the custom for a receiving clerk to sign for them and ask that they be delivered in the parking lot across the street. Some truck drivers "forgot" to make the delivery, so whole orders of parts were mysteriously disappearing . . . Biggest cause of loss, however, is still via pockets, lunch boxes, and cars. One company, last winter, set up a check point on the road out. After the first few cars were searched, "the word" was passed back, and all sorts of objects rained out of following cars into the snow. The scare, however, had its effect.

News of Metalworking . . .

TAFT-HARTLEY'S NEW LOOK

While Congress beats about the bush on controversial T-H, the new NLRB is quietly changing the rules by reinterpretation — and its recent policy rulings will make themselves felt at the bargaining tables before long

WASHINGTON — The Taft-Hartley Act is getting a new look. It's being changed — not by act of Congress — but by reinterpretation of its regulations. And the changes will be felt from the collective bargaining tables down to plant-level labor-management relations.

Congress this session failed to legislate any new rules for the controversial labor law, but the National Labor Relations Board has picked up the ball, and with a series of new policy decisions, is changing the rules of behavior for management and unions.

Several important decisions encompass the entire field, while one is directly aimed at the aircraft industry. All are important to metalworking.

The NLRB is now manned by a three-man Republican majority — all of them hand-picked by President Eisenhower. This team views the provisions of Taft-Hartley (many of which are extremely fuzzy) in a different way from the old Democrat-dominated board. Most of its changes are those long sought by management.

In rapid-fire action recently, NLRB handed down three key rulings. One, particularly, may substantially alter the bargaining tactics of unions in the future.

This ruling concerns the union's right to strike during the life of a contract. Under the old NLRB rules, unions felt legally free to call a walkout on 60 days' notice, even though a contract was still in effect — unless it contained a no-strike clause.

The new agency has banned this practice. It holds that strike action is illegal until the expiration date of a contract, or if a contract contains a wage-reopening clause, until that date has arrived. Reason for the ruling: to give more sanctity to the terms of a contract.

Universal No-Strike Clause?

This in effect writes a no-strike clause into every contract. Currently, many contracts contain such clauses, but it has been arrived at over the bargaining tables, with the unions agreeing in return for benefits received. Now, no-strike is built-in, and it gives management a shot in the arm at negotiation time.

Unions can, of course, strike at any time. And they still can walk out over alleged unfair labor practices during the term of a running contract. But economic strikes while a contract is still in effect are no longer a protected activity, and an employer is under no obligation to re-employ striking workers.

The Unions Protest

The practical result of this ruling, already under verbal bombardment by union officials, will probably be a labor drive for shorter-term contracts, or more re-opening clauses in long-term agreements.

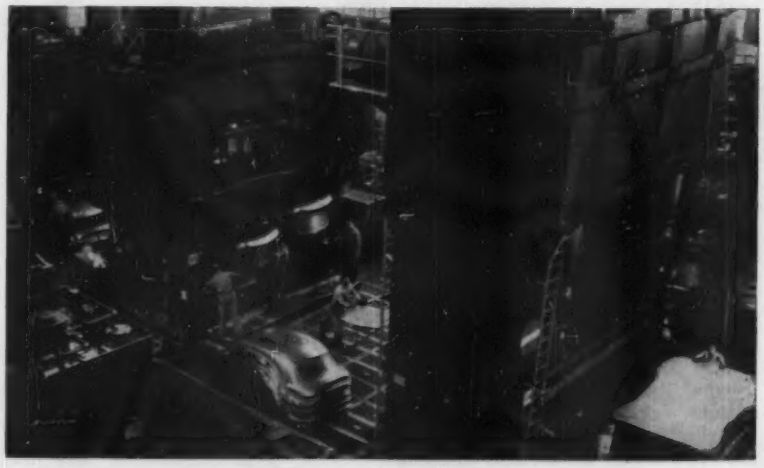
In this connection, NLRB came up with another ruling on long-term contracts in the aircraft industry. By a 3-2 majority, it held that three-

OUTPUT TOPPED ONLY BY RENAULT

PARIS—(McGraw-Hill World News)—Newest giant in the French motor car industry was born recently with the absorption of Societe Ford SAF (French Ford) by SIMCA, French affiliate of Italy's Fiat.

The new combine ranks second in size only to the French-government-owned Renault works. SIMCA alone expects to produce 100,000 units this year—over 20% of total French passenger car production. Recently, SIMCA turned out its 200,000th "Aronde."

SIMCA will continue to produce French Fords at Societe Ford SAF's plant at Poissy, near Paris. Output of the two lines will make the fast-growing SIMCA combine a serious challenge to Renault.



SIMCA has some of Europe's most modern presses . . .

FRANCE'S NEW NO. 2 AUTOMAKER:

ECONOMIC COOPERATION ADMINISTRATION supplied these modern American-built presses that help turn out 400 cars a day at SIMCA's Nanterre plant

year contracts are a bar to an attempt by an outside union to represent workers at a plant.

This decision uproots the old board's position that contracts running longer than two years can be challenged by a raiding union. The majority added the extra year after finding that 42% of employees under contract in the aircraft industry were under agreements running three or more years.

This ruling, involving Long Island's Republic Aviation Corp and the International Association of Machinists (AFL), means less union jurisdictional battles in the aircraft production field.

The third key board ruling will be felt right down to the plant level of management-worker relations. NLRB for the first time opened the door to employers by allowing limited questioning of workers as to their union affiliation or activities. Up to now, any interrogation has been banned as unfair labor practice.

Now NLRB says an employer may ask a worker about his union sentiments, provided the employer does not imply that any benefit or reprisal will accrue for such sentiments.

This is a thin line for the employer to walk — and he does it at his own risk. But the decision eases the clamps on the employer's freedom of speech within his own plant.

Vance Heads New ODM Industry Review Board

Top-level industry team will have final say-so on US spending to boost critical components production capacity. Its chairman: the man who started the standby production idea

WASHINGTON — Office of Defense Mobilization has set up an "Industrial Review Board," whose job it will be to pass on all planning and spending under the government's program to boost capacity for production of critical industrial components (*AM* Aug 2 '54 p91).

Harold S Vance, Studebaker Corp president and author of the Vance Plan for standby defense production lines, will head the board, with six other industrialists and ex-military leaders yet to be named as members.

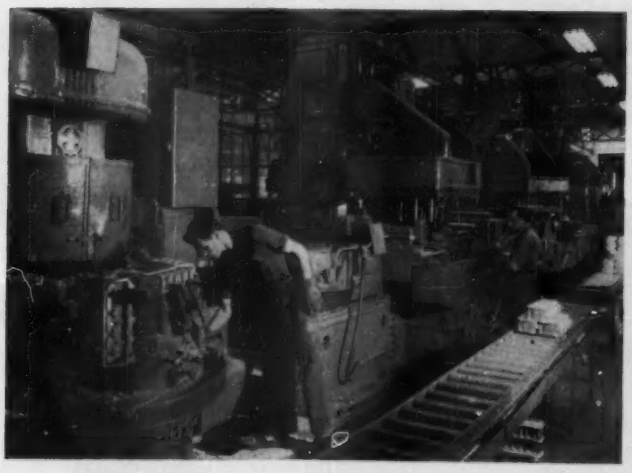
The new board will (1) review capacity deficiencies reported by defense agencies and by advisory committees of component manufacturers, and (2) approve individual projects to overcome shortages.

Here's how ODM plans to remedy component capacity deficiencies:

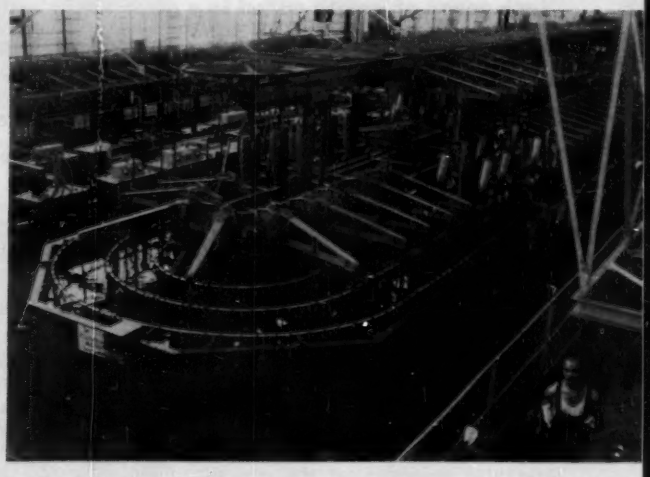
- Installation of machine tools, to be maintained on a standby basis, in the factories of component makers.
- Stockpiling the most-critical semi-finished steel products used by component producers.
- Develop substitute products that would be scarce in emergency.

First project to come under the board's jurisdiction is a plan to stockpile about $4 million worth of wide-gage steel plate and special stainless steel tubing. The steel would be stored as "rotating inventories" in plants of several boiler manufacturers.

Steel producers have pooh-poohed the plan. They argue that it's impractical — that boiler plate produced for military products isn't always suitable for civilian goods. This is a sample of what will come up under the component capacity program — now it's up to Mr Vance's board to turn thumbs up or thumbs down on it.



machine tools . . .

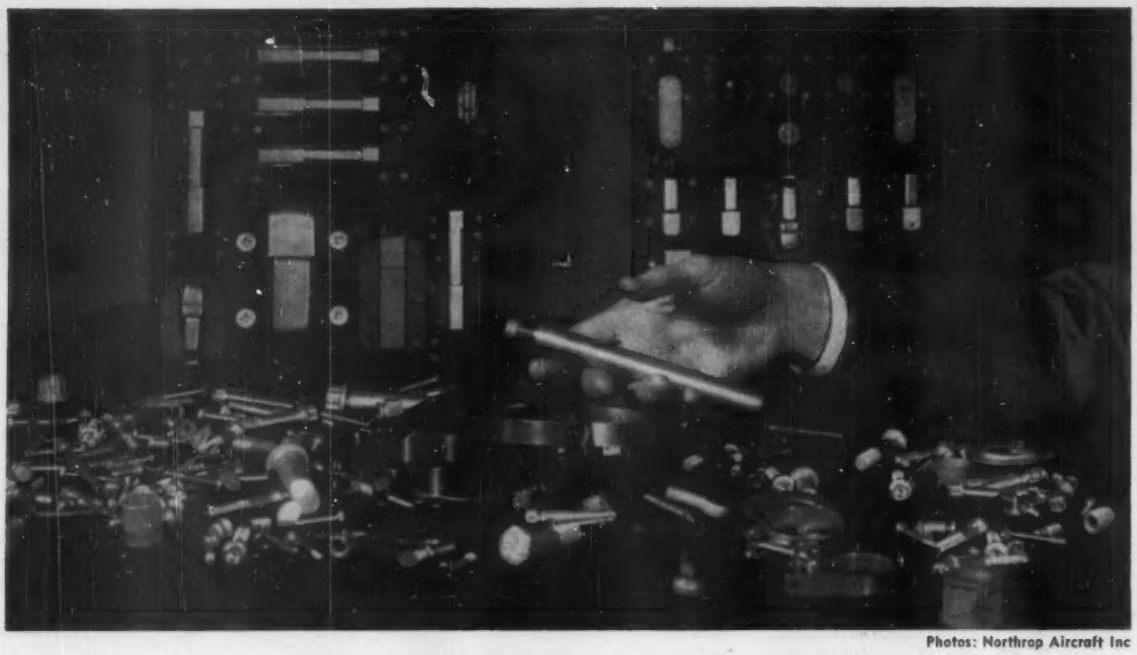


and plating equipment

Fiat-Affiliated SIMCA and French Ford Merge

OTHER US-BUILT EQUIPMENT AT SIMCA includes this rotary miller and line of drilling machines

SIMCA'S CHROME-PLATING production equipment is said to be the most modern in Europe



Photos: Northrop Aircraft Inc

TITANIUM FASTENERS:

Planemakers Pool Technology to Improve Them

"Each pound of weight added to a given configuration affects the performance (of a plane) to a far greater degree by virtue of resultant growth and functional requirements."* That's the thinking behind NASC's search for ways to replace heavy metal fittings and fasteners with lighter, stronger titanium

* TRANSLATION: "Keep the weight down — or it'll never get off the ground."

HAWTHORNE, CALIF—Movie stars have nothing on jet-plane designers when it comes to watching the scales —particularly when you figure 1 lb of metal far out on a wing may take as much as 10 lb of supporting material. Aircraft designers can offset this by machining and paring down structural members, at the cost of integrity and strength—or they can use lighter, stronger fittings. Replacement of comparably heavy metals, such as steel, with titanium fasteners and fittings has saved as much as 500 lb in a single plane.

The aircraft industry had these facts in mind when the National Aircraft Standards Committee held a Western Division Titanium Symposium this spring in Forth Worth, Texas, the results of which have just been made public:

- Industry, suppliers and fabricators agree unanimously on the need for titanium fasteners and fittings to minimize "growth factors" in today's high-speed planes.
- Suppliers and fabricators have asked the aircraft industry to help in development of types and sizes of titanium fasteners.
- Direct interchangeability of titanium fasteners with steel fasteners is essential.
- The aircraft industry's first need is for fasteners of 3/16 to ½-in. dia of the shear type, with tension types to follow.
- Titanium fasteners must have functional capabilities equal to those of steel (95,000 psi shear value).

106,000-150,000 psi Shear

- Alloys that will become available in the near future include some with average shear strengths from 106,000 to 150,000 psi, with good stability, impact and fatigue criteria. Some of these may be available by year's end.
- There is a need for a greater interchangeability of test data and a coordinated titanium test program.
- Aircraft fabricators report a need for automatic, high-speed, hot-heading machines. It is reported these machines may be available within two years.
- Teamwork between users, fabricators and suppliers of titanium can assist greatly in overcoming current problems in the development and use of titanium fasteners.

• Several top US aircraft manufacturers are already purchasing titanium fasteners, built to their own specifications, for use on new models.

In line with titanium fastener fabrication and supply problems, representatives of leading West Coast airframe builders and supply firms showed greatest interest in development of 3/16- and ¼-in. fasteners of the AN3, 509, NAS220 and NAS 464 types. But, the suppliers said, while they can cold-draw ¼-in. dia stock and above successfully, they have difficulty in achieving the 3/16-in. dia material.

A Convair man reported that tests at his company indicate a good possibility of direct substitution on shear applications. He added that interchangeability with 95,000-psi fasteners is well within the realm of current material.

Douglas Aircraft has been working on a composite, builtup tension fastener made up of machined barstock parts brazed together, which may be better for large sizes than hot-headed single-piece fasteners. Douglas feels that more effort is needed to cut titanium fastener costs, and that weight savings are not justified at present prices.

Aside from fasteners, many other titanium aircraft products can be developed: rod ends, cable fittings, hydraulic fittings, washers, clamps, etc—in fact, anything now made of steel, corrosion-resistant steels—and brasses.

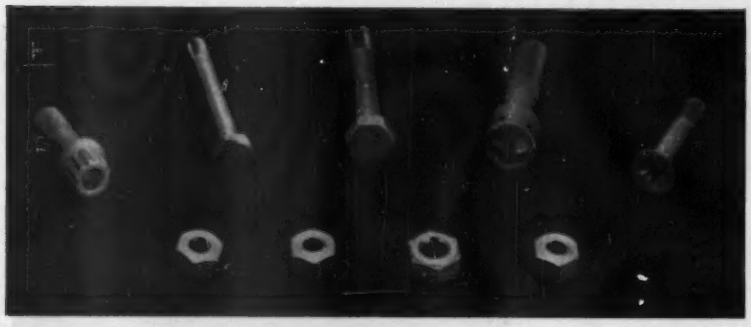
One fabricator, Voi-Shan, said it is difficult to cold head titanium fasteners in the same manner as steel fasteners, and that it will be necessary to change over to hot heading. The design of hot heading machines is vital, a Voi-Shan spokesman said.

Weight Savings

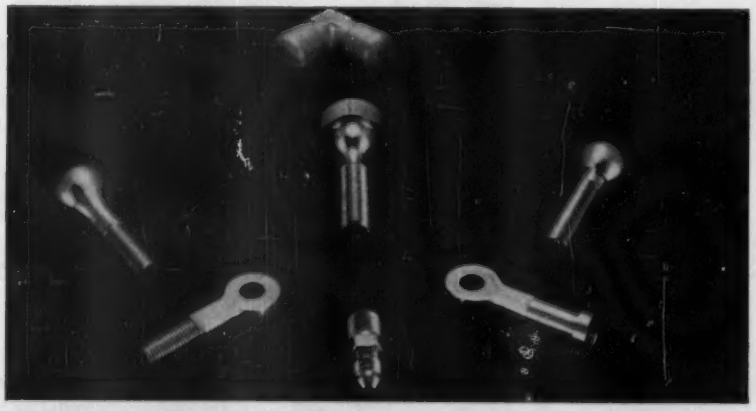
Dependent upon the stage of design or production and the urgency of reducing weight, the value of 1 lb of aircraft weight varies from $25 to $200.

A Rem-Cru Titanium representative said he believes the price of titanium will eventually drop to $5. (Sponge is already down to $4.52, high-quality, commercially pure sponge to $4.76.) New methods of working scrap will help bring costs down, he said.

Douglas Aircraft is emphasizing direct interchangeability with steel fasteners, so that if titanium is in short supply, the company can fall back on steel fasteners.



STANDARD AIRCRAFT FASTENERS such as the ones shown here are already available in titanium instead of steel



THESE STANDARD PLANE FITTINGS, produced from titanium alloys, are already in use by Northrop Aircraft Inc for investigative purposes

Structural Requirements

The consensus of aircraft manufacturers is that titanium fasteners should have a minimum 95,000 psi shear value.

One supplier, Rem-Cru, said that an average shear of 96,000 psi is readily obtainable, but that it has no specific correlation to tensile strengths, which range from 134,000 to 158,000. The shear strength, Rem-Cru says, should always be controlled, rather then tensile strength. While heat treatment for 130B needs improvement, it looks like this alloy will have an average increase of 10,000 psi, with a possible 2% sacrifice in elongation.

A fabricator, Voi-Shan, reports that rolled threads at about 850 F on a specific bolt test resulted in a tensile strength of 8800-9700 lb. Stress relieving at approximately 1400 F increased tensile strength to 15,000 lb.

A supplier said that shear fasteners of 140,000-160,000 tensile strength, after 12 different heats averaged 93,000-108,000 psi shear strength. Forgings or bolts hot upset at 1900 F show a reduction or elongation that could be restored by annealing 1-2 hr at 1400 F.

Available Materials

Material suppliers are currently working on high-strength, heat-treatable titanium alloys tentatively in the 200,000 psi range, with acceptable formability and forgeability characteristics. Example: a 3% manganese complex alloy developed by Battelle Memorial Institute and currently under study by West Coast airframe makers.

Some of the alloys under development are susceptible to strain aging, and, when they are subjected to constant stresses at high temperatures, become brittle. This can sometimes be prevented by annealing at 1200-1400 F for 24 hr.

Titanium Metals Corp is working on several alloys: TI 140A, with an average shear strength of 95,000 psi;

TITANIUM FASTENERS

(Continued)

TI 150A, average shear strength 150,000 psi; TI 155AX, average shear strength, 106,000 psi. All of these alloys have good stability, impact and fatigue characteristics.

Harvey Machine Co has an Air Force research contract to develop extruded material for fabricating fasteners and fittings from extruded bar. Tests to date show a much more uniform product than drawn material.

Available Test Results

Titanium suppliers, fabricators and airframe manufacturers attending the symposium agreed to a free exchange of test data, and recommended that a joint ARTC test program be established.

Convair reported at the meeting that it has been working on a fatigue life program based on the bolts the company has received from various vendors. The result: Convair has been able to increase fatigue life as high as a 1000% by sandblasting with 320 grit. In one case, fatigue life was increased almost 2500%. Vapor honing was initiated to obtain a better parts surface finish, and while it produced no noticeable improvement in finish, did increase fatigue characteristics.

Navy Bureau of Aeronautics has investigated anti-seize coatings, such as teflon and molybdenum sulphide. General Electric has been working on a silver and rhodium plating method. And Convair reported that its experience has shown that silver plating separates from titanium at high temperatures after 250 hr.

CORRECTION

Newark Gear Inc of Newark, NJ, was erroneously announced as having been purchased by Potter & Johnston, subsidiary of Pratt & Whitney, Division Niles-Bement-Pond Co. Newark Gear is still very much in business for itself — manufacturing gears of all types to specifications, and doing special machining jobs. Potter & Johnston has taken over Newark's gear machine business, and will build, sell and service Newark gear hobbers, gear cutters, gear cutter grinders and gear testing machines.

USSR Induction Forges

Presses instead of forging hammers, high-frequency heating in place of oil or gas — those are the ingedients of a new cost-saving Russian technique

NEW YORK — Presses of 500 to 4000 tons capacity are replacing forging hammers, and high-frequency (2500-4000 cps) heating has taken the place of oil or gas heating in one Russian forge shop, a Soviet technical journal says.

About 90% of the stock is cut with mechanical shears. Cut pieces then move longitudinally through the heater, and the transversely cut pieces are forged immediately after heating. Applied heating frequency is 8000 cps for material up to 40mm dia; 2000 cps for larger diameters. Power consumption is 450-500 kwh per ton of heated material. Average weight of forgings is 1.89 lb.

Main advantage of using forging presses is that all operations can be automatically controlled. Other advantages: more output, materials savings, improved working conditions. For a specific application, a 1-ton hammer has been replaced by a 1000-ton press, which is driven by a 50-kw motor, rather than the 120-kw motor required to furnished compressed air for the hammer.

Average materials saving for 31 types of forgings is reported as about 14%, including a 2% savings from reduced burn-off and decarburization. Productivity is increased on the order of 30% for most components; as much as 140% for certain others. Example: output of connecting rods increased from 163 pc/hr with drop forging to 390 pc/hr with presses. For crankshafts: 68 to 87 pc/hr.

Cuts Machining Costs

Less machining is required with the press-hf heating technique, with average rate of machine-off chips running about 8% less.

Total reported savings of the new process over the old are (1) materials 14%, (2) fuel 25%, (3) labor 30%, and (4) dies, power and repairs 25%. And, with uniform high-frequency heat, there are no failures because of stresses.

The Prince and the Miller

PRINCE PHILIP, Duke of Edinburgh, looks over a vertical milling machine at a recent industrial productivity exhibition sponsored by the British Ministry of Supply

FIFTIETH ANNIVERSARY
OF
THE MOTCH & MERRYWEATHER
MACHINERY COMPANY
PRESENTED TO THE SONS OF THE FOUNDERS
E. FRANKLIN MOTCH
GEORGE E. MERRYWEATHER
EDWIN R. MOTCH, JR. 1901 — 1953
CONGRATULATING YOU UPON YOUR SUCCESS
IN MAINTAINING THE HIGH STANDARDS
ESTABLISHED BY THE FOUNDERS AND EXPRESSING
THE CONTINUED LOYALTY OF THE ENTIRE
ORGANIZATION TO THIS IDEAL
1904 — 1954

From 6 employees . . .

to 6 Divisions in half-a-hundred years

Motch & Merryweather's 50th Birthday

From six employees to six divisions is the half-century growth record of Motch & Merryweather, Ohio machine-tool distributors, builders and rebuilders. Still a family affair today, the company is constantly expanding and broadening into new fields under the leadership of its founders' sons

CLEVELAND — It all started back in 1904, when three young graduates of the same MIT class — Edwin R and Stanley Motch, and George E Merryweather — pooled their capital and technical abilities to form a distribution outlet for machine tools in Ohio and southeastern Michigan. The company had just six employees at its beginning 50 years ago.

Today, Motch & Merryweather still represents many of those same machine tool builders. That, and an excellent reputation, are just about all that the original company and Motch & Merryweather of today have in common.

Today: 500 Employees

Today, Motch & Merryweather's original six employees have grown into a work force of 500, divided among three plants and the company's Cleveland headquarters. And the company has expanded into five other fields besides its original distributing business:

- The Machinery Manufacturing Division, which designs and makes production milling machines, automatic transfer machines, vertical turning machines, circular sawing machines and blade sharpeners, and special machinery.
- Cutting Tool Manufacturing Division, at the Euclid plant.
- Cutting Tool Distribution Division, at Euclid.
- Used Machinery and Rebuilding Division, also at Euclid.
- Triple M Products Division at Ganes Mills, Ohio, represents a diversification of product, manufacturing a combination power mower, cultivator and snow remover.

The company's original distributing business has kept pace with this rapid expansion into other fields — it now represents many of America's most prominent machine tool builders in a much-widened territory that includes all of Ohio, eastern Michigan, eastern Kentucky, western Pennsylvania, West Virginia, and part of Maryland. And Motch & Merryweather has its own branch sales offices in Detroit, Pittsburgh, Cincinnati and Dayton. Its manufacturing divisions are represented by dealers all over the country.

Officers Active in AMTDA

First president of the company was George E Merryweather, who was one of the organizers and first president of the American Machine Tool Distributors' Association, and who served as Chief of the Machine Tool Section of the War Industries Board in World War I. Mr Merryweather died in 1930, and was succeeded by Edwin R Motch, co-founder and secretary of the company, who held the presidency until his death in 1947.

Each of the three founders had a son who entered the business. Edwin R Motch, Jr, lately returned from service as an Ordnance colonel during World War II, succeeded his father as president; E Franklin Motch became vice president and

E FRANKLIN MOTCH
President and Treasurer

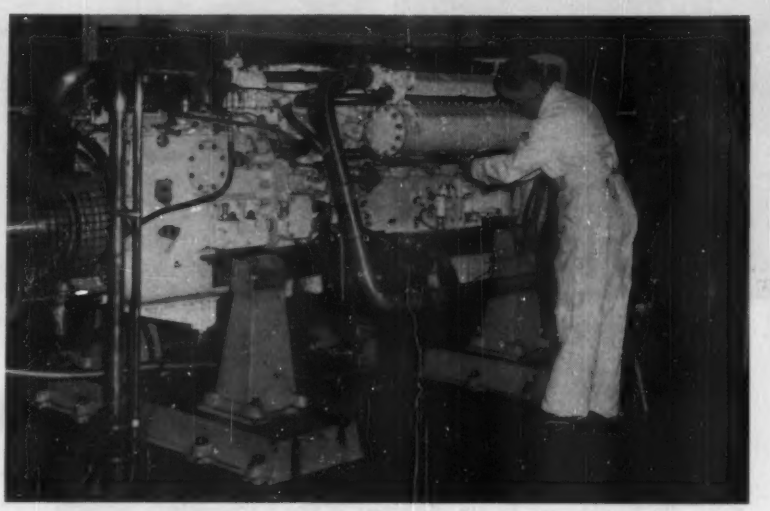
GEORGE E MERRYWEATHER
Vice-President and Secretary

50th BIRTHDAY (cont'd)

treasurer; and George E Merryweather, secretary. The latter two had served as Naval commanders.

Edwin R Motch, Jr, during his term as president was responsible for much of the company's expansion into the machine-tool building and cutting-tool manufacturing fields. At the time of his death in 1953, he was first vice president of AMTDA. The company's present president, E Franklin Motch, also assumed the duties of treasurer upon his election. George E Merryweather was named vice president and secretary.

Aside from members of the Motch & Merryweather families, the man best known to the trade during the firm's first 50 years was the late Alvin B Einig, known to machine tool people as "Abe." He began with Motch & Merryweather as a sales engineer in 1904, and was general manager of the company at the time of his death in 1949. Mr Einig, who served as a member of the War Industries Board in World War I, was the first man called to organize the Tools Section of the War Production Board when World War II came along. Active for many years in AMTDA, he was its president from 1944 to 1946.



Rolls-Royce Gas Turbines for US Navy

FIRST OF A TRIAL ORDER OF 6000-HP GAS TURBINES, a marine conversion of the Griffon aero engine, undergoes final adjustment in tests at Rolls-Royce's Derby, England, plant. Turbine operates on 100-octane gasoline, turns up 1700 emergency shaft hp, has continuous cruising rating of 1100 hp. Other features: single lever works throttle and reversing gear, completely electric instrumentation, cartridge starting. In earlier tests, two of these turbines installed in a British gunboat of 220 tons increased power 50% over two 4000-hp steam turbines, cut machinery weight 50%, saved 25% in space

AMMO PROCUREMENT FOR NATO:

Senate Raps European Buildup-US Cutback

The Senate is taking an increasingly dim view of the Defense Dept's "abortive effort" to beef up offshore ammunition procurement for NATO at the expense of US producers — particularly when Europe's ammo industry at peak output could supply only 25% of NATO demands

WASHINGTON — Defense Dept officials have been sharply rapped by the Senate Armed Services Committee for cutting back on ammunition procurement and production in the US, and at the same time attempting to build up offshore ammunition procurement for NATO forces.

Europe's munitions makers, says the committee, are plagued with shortages of facilities for production of chemical components, propellants and loading devices. And, the committee claims, even if these facilities were balanced with European metal capacities, Europe's ammunition makers could supply only about 25% of European NATO requirements — and the United States would have to supply the rest in an emergency.

So why, the committee wants to know, is the productive capacity of US ammunition makers continually being reduced? US ammunition output at 1953's end was about $260 million a month. Today, it's about $200 million a month — with a gradual decline to around $170 million expected by year's end.

Korea proved that it takes 18-24 months to get shut-down ammunition plants back into production. European munitions makers obviously can't even come close to supplying NATO, and the bulk of output will fall back onto US makers in an emergency. Why, then, build up offshore procurement at the expense of the US producers who will have to save the bacon anyway in the long run? The Senate would like to know the answer:

"If these countries must be reliant on the United States for essential ammunition component parts . . . we feel this apparent lack of self-sufficiency justifies a re-appraisal . . . with the possible result of producing the ammunition in the US."

Herbert A Silven

Charles E Schell

George E Gernon

Names in the News . . .

Herbert A Silven has been named chief engineer of Norton Co's Grinding Machine Div. A Norton machine designer since 1916, Mr Silven did much of the original work on the company's first automatic cam and crank grinding machines. He succeeds **Carl G Flygare,** one of the country's foremost grinding machine designers, who has retired after 47 years with the firm.

Kenneth N Scott, production manager of the Wilmington, Del, plant of the General Motors Buick-Oldsmobile-Pontiac Assembly Div, has been named manager of the B-O-P plant in Arlington, Texas. Mr Scott was associated with GM's Fisher Body Div from 1935 until his transfer to B-O-P in 1947. He served in various capacities at the Wilmington plant before being named production manager in 1952. He succeeds **Edwin C Klotzburger,** transferred to Fisher Body, where he will be assistant to the general manager on special assignments. **Milford L Rodgers,** general superintendent at Wilmington for the past year, succeeds Mr Scott. **Sidney W Roche,** superintendent of the trim department, takes over Mr Rodgers' duties.

Donald A Comes has been elected vice president of Farrel-Birmingham Co, Ansonia, Conn; he will continue to hold his present position as general sales manager. Mr Comes has been associated with the company since 1922; he was named manager of the Banbury Mixer Dept at the Ansonia office in 1943, assistant general sales manager in 1946, and last year was appointed sales head.

Charles E Schell has been appointed assistant to the plant manager of John Volkert Metal Stampings, Queens Village, NY. Mr Schell had been associated with Sylvania Electric Products for 25 years, most recently serving as plant manager of the Parts Div.

John Lawrence has been elected executive president of Joy Manufacturing Co, Pittsburgh. He joined the company in 1951 as vice president of manufacturing, and was named vice president of manufacturing and engineering in 1953. Mr Lawrence was formerly vice president of SKF Industries, and factory manager for Jones & Lamson Machine Co.

Joseph F Whitaker has been appointed vice president, sales, of Weller Electric Corp, Easton, Pa, manufacturers of soldering guns, kits, and power sanders. Formerly associated with the International Resistance Co of Philadelphia, Mr Whitaker joined Weller last year as sales manager.

Zeus Soucek has been appointed general manager of General Mills' Mechanical Div. He replaces **Charles D Elliott,** who died in May. Mr Soucek has been serving for the past four years as government sales manager for the Allen B DuMont Laboratories, Clifton, NJ. Between 1929 and 1950 he was successively engineer in charge of research for the Bendix Aviation Corp, vice president of W L Maxson Corp, vice president of Brewster Aeronautical Corp, president of the Philharmonic Radio Corp, and president and owner of the Arpin Construction Co, Orange, NJ.

George E Gernon has retired as an active member of Gisholt Machine Co's board of directors. Mr Gernon has been a member of the firm for 54 years. He is continuing as secretary of the company, a post he has held for the past 49 years. **Howell W Murray,** vice president of A G Becker & Co, Chicago, has been elected to the Gisholt board of directors.

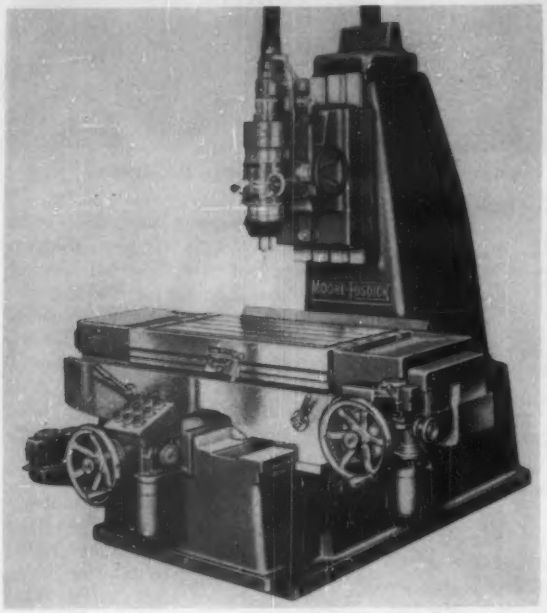
Howard J Evans, former chief engineer of Rockwell Manufacturing Co's Pittsburgh Equitable Meter Div, has been promoted to chief engineer and manager of the Central Gas Products Research & Development Dept. **H A Altorfer,** former chief engineer of the Nordstrom Valve Div, Oakland, Calif, has been named chief engineer and manager of the Central Valve Research & Development Dept.

OBITUARIES

Alfred J Porter, 58, a vice president and director of Heppenstall Co, Pittsburgh steel forgings manufacturer, and manager of the company's plant at Bridgeport, Conn, died suddenly at his home in Bridgeport on Aug 11. Mr Porter served as president and director of the Connecticut subsidiary since 1942. He was elected a vice president of the parent company last February.

Lucien I Yeomans, 76, construction engineer, died in Evanston, Ill, Aug 16. Mr Yeomans, who headed his own firm at the time of his death, was well known in the designing field. During World War I he designed the original shell lathe for the Army, unique at that time in that it could be turned out quickly and cheaply at the rate of one a day. He was associated during his lifetime with Brown & Sharpe, the Multigraph Co of Cleveland, and on special assignments for RCA.

New Shop Equipment,



Moore Head Combined With Fosdick Table

Top accuracy, versatility, and precision are claimed for the Moore-Fosdick jig grinder, a combination machine for automatic positioning to ±0.0001 in. Special features include ability to grind cylindrical and tapered holes, conical holes with taper in either direction, and accurate grinding of any contour—permitted by built-in angular and indexing device in the main spindle, and by a new slot-grinding attachment.

Grinding speeds range infinitely from 12,000 to 60,000 rpm; and four spindle speeds are available—90, 120, 180, and 240. Spindle feeds are air-powered, hydraulically controlled. Spindle adjusts for a total 3° angle. Standard equipment includes motor, wheel dresser, micrometer stop, and wrenches. Also included are two built-in locating mechanisms, one a pair of 1-in. 0.0001-in. outside micrometers, and the other a set of end measures in a box. These are for 1, 2, 3, 4, 5, 10, and 15 in.

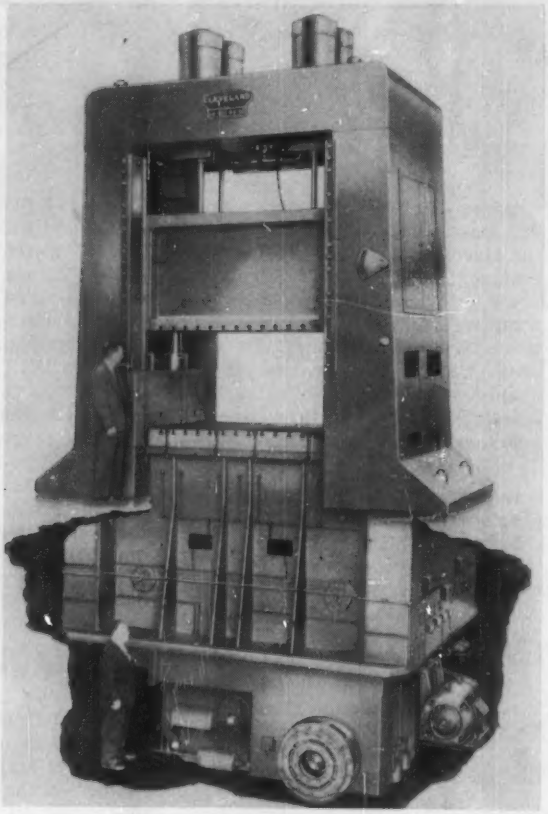
Two simple duplicating bars are set up for locating holes to be ground; they use the axis system. The ⅝-in. bars are placed in troughs after position holes have been located and drilled, and a pin is inserted in each hole to allow bringing the table to position.

Bars may be saved for later jobs with the same dimensions.

Planetary motion within the spindle allows exact location of point of origin from which any portion of a contour is generated. Planetary motion can be power-fed if the work has no obstructions, or hand-fed where motion must be limited because of interference.

Electric heating elements in the main spindle housing hold temperature to eliminate variations in dimension. Other top-quality features insure long life.

Fosdick Machine Tool Co, Cincinnati 23, Ohio



Underdrive 450-Ton Press Fits in Automatic Lines

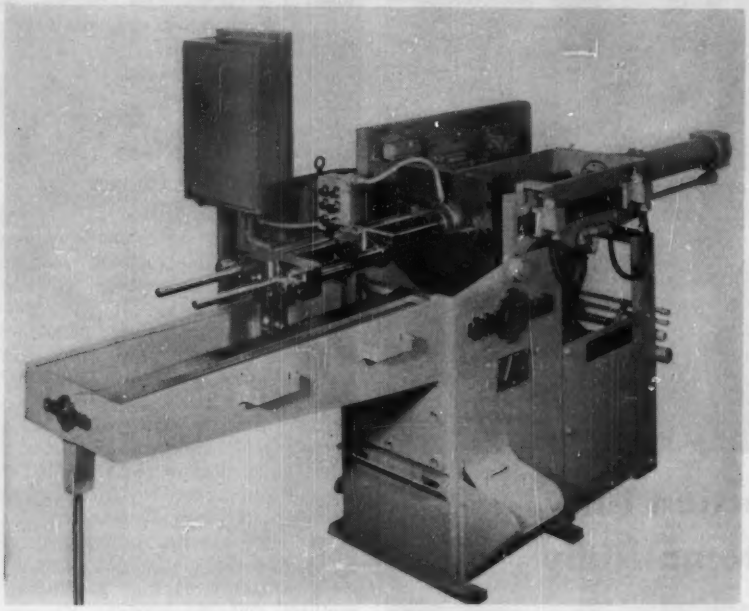
Double-geared, twin-drive Cleveland U4-450 84-60 press is arranged with air-counterbalance for the slide and air brake on the flywheel, to work automatically when power is cut off. Dynamic clutch and pneumatic cushions in the bed are features.

Underdrive construction simplifies maintenance, allowing adjustments and repairs at floor level. Limited press height above floor helps lighting conditions and material flow. Drive mechanisms with oil and grease fittings are in a separate area, which helps in keeping the press area clean.

Press has 20-in. stroke, slide and bed area of 60x80 in., and rated capacity of 450 tons.

Cleveland Punch & Shear Wks Co, Cleveland 14

Materials and Parts . . .



Versatile Colonial Unit Performs Four Broaching or Press Operations

Colonial "4" will handle push and pull-down broaching as well as press operations in the vertical position, and in the horizontal position (illustrated) it provides all of the advantages of horizontal broaching.

Unit is designed to operate both as a utility and straight production machine. Horizontal and vertical positions of the working bed are assumed by pivoting bed section about the top of the base by means of a hydraulic lift cylinder. In horizontal position, a chip pan containing the guide support is attached to the base.

Power for the lift cylinder is supplied by a hydraulic pump and motor unit mounted on a separate base that also houses the hydraulic fluid. This power unit may also be used as an auxiliary hydraulic take-off for other uses. Coolant pump and reservoir are housed in main base. Both base and working bed section are weldments. Table for supporting work-holding fixtures is integral with pivoting bed section.

In the vertical position model requires a floor space of 84 x 40 in., and in the horizontal, the machine occupies 132 x 40-in. space.

Colonial Broach Co, Box 37, Harper Station, Detroit 13, Mich

Endothermic Gas Generator

Endothermic gas generator for controlled-atmosphere furnaces, producing 1250 cfh output capacity, is known as G-1250-G. Atmospheric air and raw gas are drawn through flow meters and pumped into catalytic cracking retort heated with multiple jet burners. When cracked, gases are cooled by water-jacketed heat exchanger. This produces endothermic gas to constant analysis. Natural gas, butane, propane, and certain manufactured gases can be processed with the unit.

Incorporated are automatic firecheck in case operating gas pressure falls below normal, and a gold fuse and thermocouple to assure operation within safe temperature range.

Ipsen Industries, Inc, 715 S Main St, Rockford, Ill

. . . including

Gear speeder inspection unit loads, sound-tests, unloads gears automatically . . page 136

Automatic loader for presses and vertical-spindle machine tools performs twelve functions in two-second cycle time page 137

Traveling-head press with 1000-ton twin heads permits straightening operations over 267-sq-ft area . . . . . page 138

Heavier medium-duty engine lathe has 18½-in. swing over ways, 24-in. center distance page 140

Bulk-material-handling conveyor, totally enclosed, has two-directional chain to convey in any direction . . . . . page 144

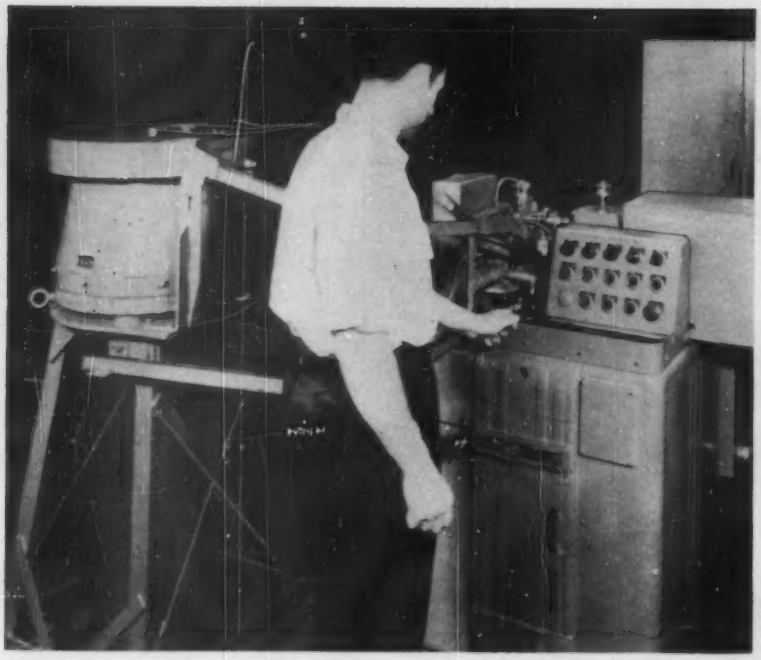
Hardness tester makes both regular and superficial Rockwell tests, utilizing all scales page 146

Hand tachometer reads from 50 to 5000 rpm, in two ranges, and indicates fpm of moving surfaces . . . . . page 150

. . . and in Sept 13

Heavy-duty surface grinder has 20-in. wheel

Single-spindle gear hobbing machine claimed to have production output equivalent to that of multi-spindle unit



Gear Speeder Inspection Unit Loads and Tests Automatically

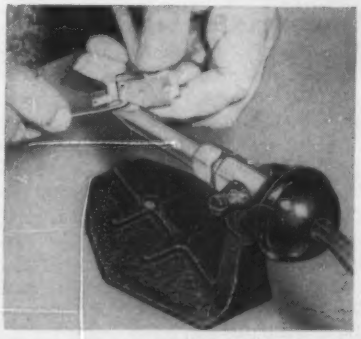
Model GSC Red Ring automated gear speeder inspection unit automatically loads, speeds spur and helical gears for sound test, and unloads gears onto a conveyor line.

Gears from a conveyor are directed to a vibrating hopper feed device in the unit from which they are fed through an input chute to a storage magazine ahead of automatic loading device on the speeder. Hopper feed operates intermittently and is controlled by loading condition of input chute.

Loader feeds gears one at a time from storage magazine into mesh with a master gear. At the moment a gear is loaded in speeding position, a finish-tested gear is dropped into unloading chute and directed back to a conveyor line. Gear is supported during test by an expanding arbor that automatically enters during loading sequence. Arbor is mounted on the headstock and expands in the bore of the gear. Diverter in the unloading chute is manually operated to direct unsatisfactory items to a table area on top of the speeder unit.

When speeding cycle starts, gear to be sound-tested is in mesh with master gear. Gear is run in one direction in mesh for a predetermined time, and a brake load is automatically applied. This is then released and gear is rotated in opposite direction. Load is automatically applied a second time, following which master-gear rotation is stopped, and loader is cycled through its load and unload functions. Air cylinders control work arbor, loader, and brake functions.

National Broach & Machine Co, 5600 St Jean Ave, Detroit 13, Mich



Electric Soldering Iron Increases Production

Fixed-base electric soldering iron is reported to increase sub-assembly production as much as 30%. Designated Model F, it features adjustable tip positioning and interchangeable tips. Adjustable to work angle, unit mounts vertically or horizontally. Tip point can be set from 1½ to 5 in. from base; tip and barrel assembly can be set to cover 180°.

Heating element is entirely within tip and higher operating temperatures at lower wattages are possible. Four interchangeable heating elements are available.

Vari Corp, 619 Fourth Ave South, Minneapolis 15, Minn

Gas-Fired Radiant Tube Atmosphere Box Furnace

Large-scale application of radiant tubes to toolroom-size furnaces was done with Lindberg's new gas-fired radiant tube atmosphere furnace. Unit is ideally suited for heat-treating virtually all production and tool steels, except high-speed, where it is essential to keep work scale- and decarburization-free.

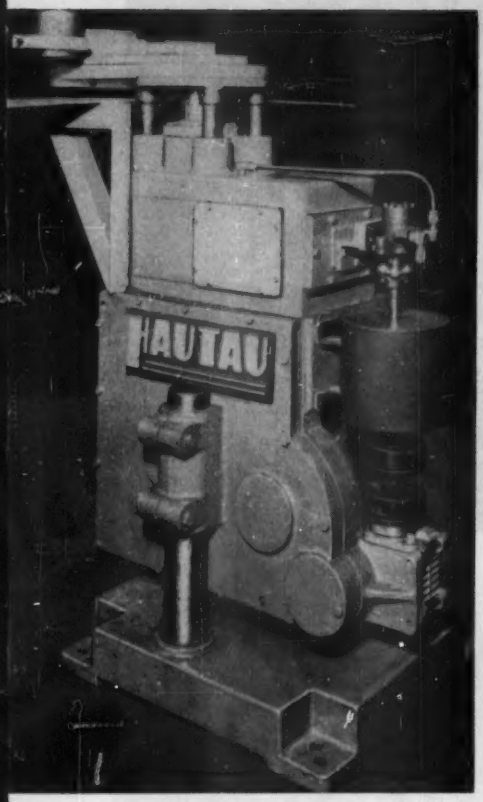
The center stream, instead of being 100% gas, is a mixture of gas and a small amount of air insufficient for complete combustion. Indentations approximately 1-in. deep and on 6-in. centers are placed around circumference of the tube, top to bottom. As stratified stream of gas-and-air mixture and the straight air surrounding it pass up the tube, the first "dimple" sets up an eddy current which mixes the air with some of the air-gas mixture, accelerating the combustion rate. As streams move further upward, additional dimples continue mixing until completed.

This design makes it possible to suspend tubes along the sides of furnace chamber eliminating need for great strength required for horizontal tubes. Tubes are made of thin-wall tubing and highest grade of nickel chromium is used. Light straight tubes give maximum heat transfer rate through tube wall and minimum internal tube temperature. All tubes are fired at lower end.

Shell is of heavy steel plate reinforced with structural members. Automatic gas-air curtain is provided which fully covers vestibule when door is opened. Furnace doors are of vertical-lift type, actuated by means of air cylinder controlled by foot-operated valve.

Maximum operating temperature is 1850 F. Lindberg fully automatic Factory Mutual approved HYEN endothermic atmosphere generators are available to provide the controlled atmosphere.

Lindberg Engineering Co, 2450 W Hubbard St, Chicago 12, Ill



Automatic Loader for Presses Speeds Parts Handling

Universal floor-model automatic loader for presses and vertical-spindle machine tools has been designed by Hautau. Motor-driven unit has two arms rotated through 120° motions permitting it to pick up parts singly from a conveyor line, deposit them in the press or machiné tool, and unload them onto another conveyor in a total cycle time of two seconds. Loaders can also be equipped with a single arm for automatic handling of parts from one press to another in a line.

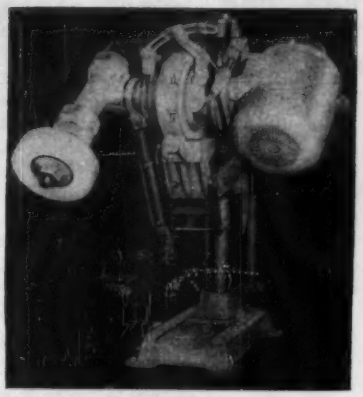
Hautau Oct-O-Pus consists of a motor, clutch, brake, and speed reducer unit; a housing enclosing gear and cam mechanisms; an actuator box on top of housing, which raises and lowers during cycle; and a rotating arm assembly attached to actuator box, which indexes during the cycle.

Actuator is intermittently powered by the motor through an electric clutch and brake unit. This positive drive is practically instantaneous in its action, and is easily synchronized with the press or machine tool through limit switches. Two concentric shafts are included in the actuator; outer shaft indexes the arms, and inner shaft controls clamping units in each.

Typical cycle is as follows: Loader arm is indexed into the press working area and lowered over the part which it clamps, raises from the die, and indexes over the exit conveyor. Here the arm lowers part onto conveyor, releases it, raises and indexes to a clear station. Simultaneously the second arm, mounted at right angles to the first, indexes over incoming conveyor, and lowers over a part. It clamps part, raises, indexes in to the press working area, lowers part into the die, releases it, raises and indexes clear of working area. Total of twelve individual functions are performed to complete cycle.

Unit occupies floor space about 22 in. by 26 in. and is approximately 46 in. high over-all.

Hautau Engineering Co, 721 Wanda, Ferndale 20, Mich



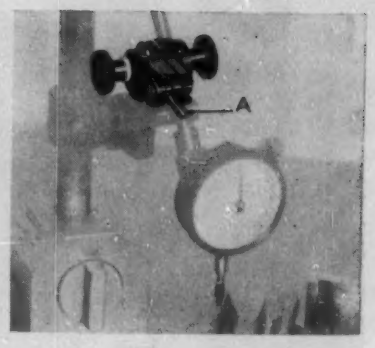
Multi-Positioning Buffing Head

Muti-positioning buffing head, Model 55, can be positioned by simple adjustment controls on front of head. It can be rotated 360° on both axes simultaneously, and automatic positioning provides constant, full contact on irregular pieces. Adjustable float restrictor controls degree of rise and drop of wheel.

Pneumatic controls for wheel lift-off are available for fully automatic installations. Fine centering of wheel over work is accomplished by additional positioning ways.

Head may be used for right- or left-hand operation by inserting fulcrum retainer housing. Any number of the Model 55 units may be installed in line on 5-ft 8-in. centers, saving floor space and costly conveyor length and fixture requirements.

The Murray-Way Corp, Birmingham, Mich



Sliding Swivel For Dial Gages

Smooth, positive positioning of dial gages graduated in ten-thousandths is accomplished by Rocheleau's fine-adjustment sliding swivel without tapping the indicator rod. This patented device has a separate clamp for each rod by which approximate setting of indicator is quickly completed. Final precise positioning is made by slight movment of lever A. No expensive dial-holding rod is required, as all adjusting is done with the device itself.

Applications cover a wide variety of inspection, toolmaking, and general machining operations. As a complete unit, it may be attached to any indicator base now on the market, or the fine-adjustment mechanism may be used on boring, milling, shaping, or planing machines, or fixtures requiring a dial indicator.

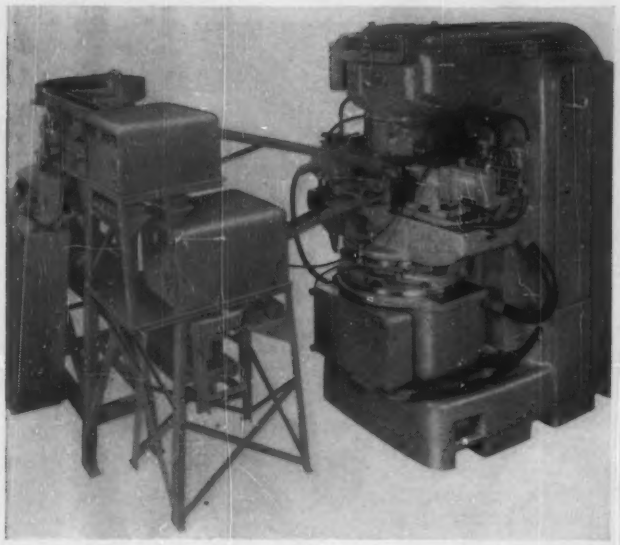
L A Rocheleau Tool & Die Co, 650 North Main Street, Leominster, Mass

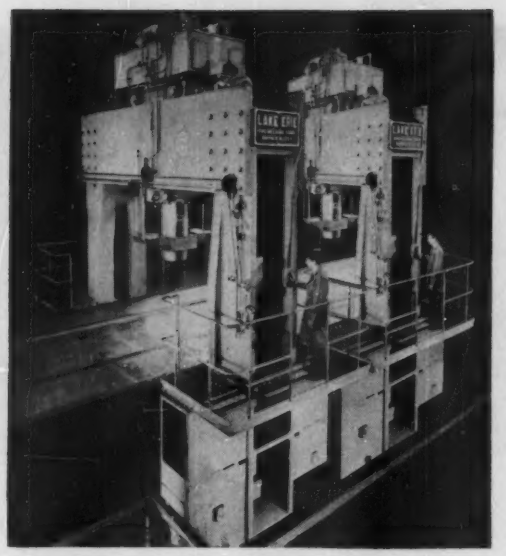
Nickel-Sulfamate Plating Process

Nickel-sulfamate plating process, developed by Hanson-Van Winkle-Munning, is reported to: plate 75% faster; be more versatile; be easier to control; and to produce harder deposits with less brittleness.

This bath plates up to 0.007 in. of nickel per hour; operation at current densities of 140 asf make this speed possible. Deposits of low internal stress are easily obtained, and wide range of specific compressive and tensile stresses are also possible. Bath is made up of nickel sulfamate, nickel chloride, boric acid, and an addition agent. Commercially tested bath has been operating for several months in electroforming installation and for 10 months in electrotyping foundry.

Hanson-Van Winkle-Munning Co, Matawan, NJ





Gear Production Machine Shaves, Inspects, and Sorts

Fully automatic gear-production machine includes vibrating hopper and straight-line feeder, automatic in and out gages, automatic loader, standard diagonal Red Ring rotary gear shaving machine, and discharge belt conveyor unit. Automatic gages shut down machine if it receives or produces too many reject parts. Signal lights on devices tell setup man what is wrong and thus cut machine downtime to a minimum.

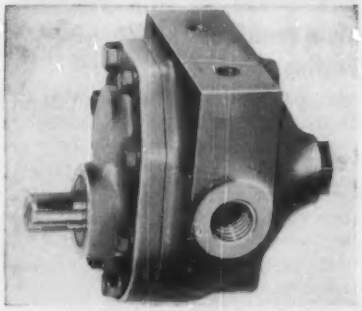
Gears are fed by main conveyor line to vibrating hopper and gear shaving, gaging, sorting, and discharge operations proceed automatically. Gears are fed from hopper and straight-line feeder through "in" gage that checks them for size and then fed into shaving machine by magazine automatic loader. Finished shaved gears are automatically unloaded from machine and fed through "out" gage that checks parts for size and helix angle accuracy. Gears are then deposited on small conveyor belt which carries them to main conveyor line.

The automated setup illustrated shaves the teeth on a 2½-in., 18-tooth, 16-diametral-pitch, 1¼-in.-OD, 16° helix angle, automotive automatic transmission pinion. Gears on which teeth have been rough cut are loaded in vibrating hopper feed unit. Operation of hopper feed unit is intermittent and controlled by mechanical feeder unit near end of straight line feeder.

Automatic loader, a Red Ring air-powered rocker design, positions gears one at a time beneath shaving cutter in Model GCU Red Ring diagonal shaving machine. Loader functions are tied in with the machine operation in such a manner that the gear is located automatically and machine goes through its cutting cycle. Unloading finger on loader picks up finished gear and places it in discharge chute where gear is directed to "out" gage.

Entire automated production unit occupies floor space about 8x9½ ft. Production setup can be altered at either end for variety of work feed devices.

National Broach & Machine Co, 5600 St Jean, Detroit 13, Mich



HYDRAULIC GEAR PUMP is for heavy-duty applications where medium weight and bulk are desirable. Unit incorporates new developments of pressure-loaded principle. Designed for pressures up to 2000 psi in capacity of 11 gpm at 2400 rpm, unit has volumetric efficiency up to 94%, and mechanical efficiency to 88%. It may be used for intermittent or continuous duty with all temperatures to 150 F—
Pesco Products Div, Borg-Warner Corp, 24700 North Niles Road, Bedford, Ohio

Traveling-Head Press Has 1000-Ton Twin Heads

2000-ton twin-carriage traveling-head press was planned and built initially for large foundry, used to straighten castings measuring 22x 10 ft and weighing over 46,000 lb.

Press dimensions are: length 40 ft, width 23 ft, height 30 ft. Bed size is 12 ft 4 in. wide and 36 ft long. Twin traveling heads each deliver 1000 tons force by 5000-psi pump and 50-hp motor. Individual carriages allow independent longitudinal movement and each traveling head can be transversely positioned to meet requirements. Each of these operations is accomplished at 120 ipm by separate gearmotors. With this control and travel, straightening operations over 267-sq-ft area are permitted.

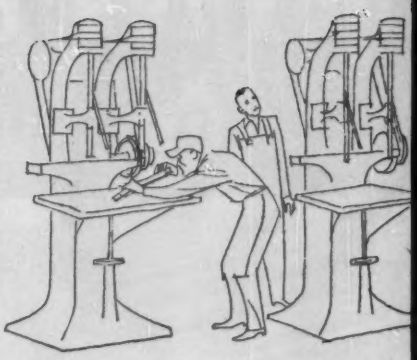
Lake Erie Engineering Corp, Box 68, Kenmore Station, Buffalo 17, NY

Hand Flaring Tool

Vis-Flare is a new hand-flaring tool added to Parker Appliance line. It is designed for rapid formation of JIC and SAE hydraulic standard 37° flares on copper, aluminum alloy, fully annealed steel, and stainless steel tubing. Six tool sizes now available will accommodate tube OD's of ½, ⅝, ¾, ⅞, 1 and 1¼ in.

Unit consists of a body, a flaring pin, and retaining spring. One-piece machine steel body incorporates bushing for hardened steel flaring pin. Hexagon body provides good grip.

Tube and Hose Fittings Div, The Parker Appliance Co, 17325 Euclid Ave Cleveland 12, Ohio



NOW'S the time to plan for PROFIT...

with NEW Leland-Gifford Drilling Machines

Right now many of us have a breathing spell in the hurly-burly of production bottlenecks and backlogs. It's a great opportunity to get set for the stiff competition coming up — to beat the squeeze on profits already being felt.

Take a good look at the drilling machines which have been fighting your production battles for years. Then compare them with the new Leland-Gifford drilling machines.

With convenient central controls, fast speed changes, reduced work handling and many other advanced features, these modern drilling machines can boost production and accuracy to the point where profits are considerably widened and competition is not only met but bettered.

Your inquiries and orders will receive immediate, complete and personal attention. Deliveries can be made *promptly*.

Get in touch with the office nearest you or write for complete information.

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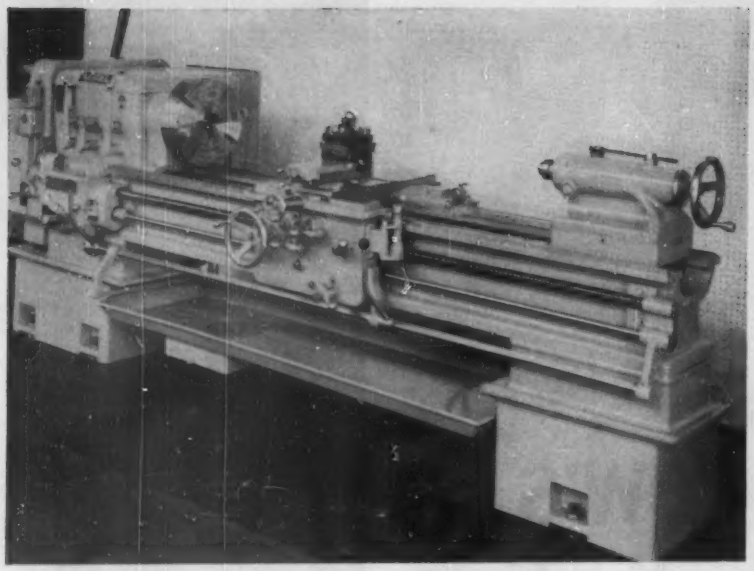
  P. O. Box 1051
- **ROCHESTER 18**
  P. O. Box 67, Roselawn Station



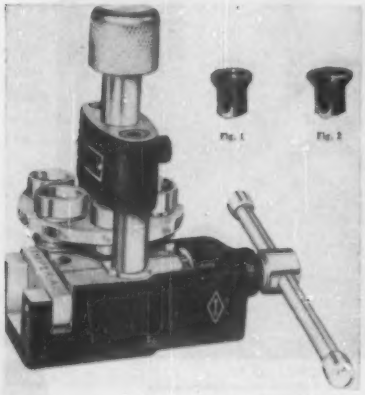
Nebel 16-in. Engine Lathe Is Heavier Medium-Duty Unit

Nebel 16-in. LA series engine lathe is said to be heavier, more powerful, to have more capacity, and to approach toolroom lathes for accuracy.

Headstock has shaved and hardened gears throughout, larger Timken anti-friction bearings, short shafts, wider gears. Helical drive gears assure smooth, powerful drive. Capacity is 18½-in. swing over the ways, 24-in. center distance on lathe with 6-ft bed. Medium-duty unit is built to accommodate a 7½- or 10-hp main drive motor, and has 12 or 24 spindle speeds ranging from 13 to 750 rpm. Apron and carriage are larger than on previous models, as is the tailstock, with larger spindle. Gears in apron and quick change box are heat-treated steel.

LA series is also made in a 20-in. engine lathe size, and in 16 – 27 in. and 20 – 30 in. removable block gap models.

The Nebel Machine Tool Co, Cincinnati 25, Ohio



Two Tools Make Double-Lap Flares

Two tools for making precision double-lap flares for fitting joints on brazed or welded steel tubing such as Bundy, or GM, and also on copper or aluminum tubing, handle 45° or 37° flares. It is stated that cracking or splitting of brazed or welded steel tubing when flaring is prevented by use of the double flare made with this tool.

Double flares are also recommended on copper or aluminum tubing where joints are to be disassembled and reassembled frequently.

The double flare is formed in two operations. In the first the tubing is belled and in the second the tubing is folded down over itself to make a double thickness flare. The tools will also make single flares.

One of the features of the tools is a positive gage to assure correct size of flare. Flare is formed true with axis of tubing and completely integrated.

Additional information is contained in Catalog No. 3011-A.

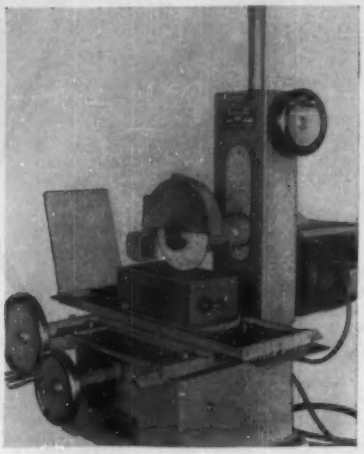
The Imperial Brass Mfg Co, 1200 West Harrison St, Chicago 7, Ill

Short Drill

Short drill was designed to get into tight spots. Unit has ½-in. capacity in steel, and construction of back spade handle allows it to be removed. Chuck speed of No. 123 with no load is 550, full load 330.

No. 383 Stanley electric drill has ⅜-in. capacity steel; chuck speed of 800 with no load, 590 with full load. This and the No. 123 may both be obtained in 115, 125, 150, 230, or 250 voltages.

Stanley Electric Tools, New Britain, Conn



Butterfly Surface Grinder Is Hand-Feed Bench-Type

Rigidity and power for heavy cuts, combined with high sensitivity for precision finishing is reported to make the Butterfly precision surface grinder SG-48 a dual-purpose hand-feed bench-type surface grinder. Axial and radial rigidity of the spindle is accomplished by mounting at both ends in duplex-mounted super-precision angular-contact ball bearings. The spindle is dynamically balanced, powered by 1/3-hp. 3450-rpm motor, rubber-cradled on resilient base. Ways are ground and lapped for accurate movement. Handle wheels are conveniently located for ease of use.

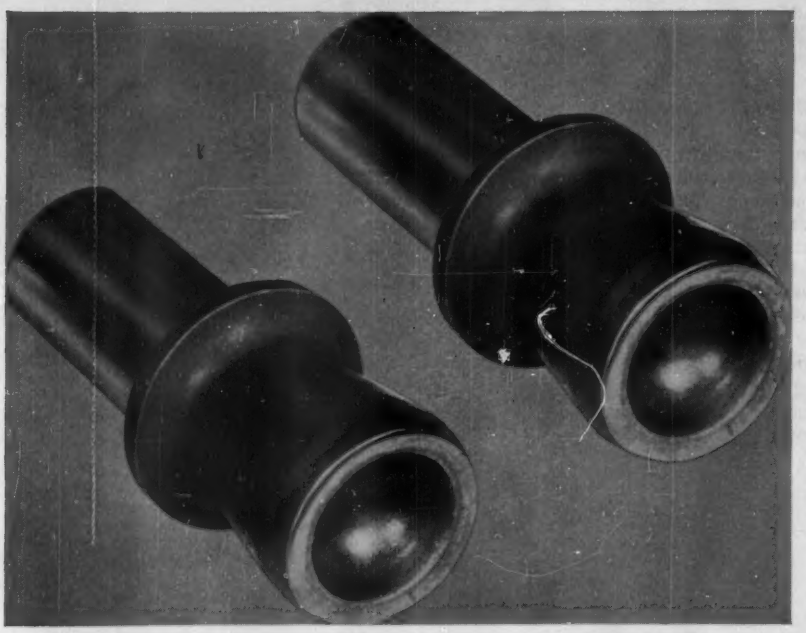
Table working capacity is 5½x9x-7½ in. under the 6-in. wheel; table travel is 10 in. longitudinally, 6 in. transversely; vertical travel is 7½ in. Spindle speed is 3000 rpm and accuracy is reported as 0.0001 in. Standard equipment includes 1/3-hp motor, 6-in. grinding wheel, wrench, belt, pulleys, exhaust-type wheel guard.

Harvey Manufacturing Corp, Germanow-Simon Machine Co, Inc, 408 St Paul St, Rochester 3, NY

Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributors: Bethlehem Steel Export Corporation



Boiler Shop Using Bearcat Rivet-Sets Ups Average Run from 300 to 2470

The mechanical department of a large boiler shop had trouble driving more than 300 hot rivets, using standard rivet-sets. Once that mark had been reached, the sets would crack or spall. Sometimes recupping saved the day, but oftener than not the sets had to be replaced.

We were sure they could get longer runs with rivet-sets of Bearcat tool steel. The management gave Bearcat a trial, and put six sets to work after a heat-treatment cycle consisting of preheating at 1200F, air-quenching at 1750, and tempering at 550.

The results were even better than expected. The average run increased from 300 to 2470 before recupping was required. Not only that, but the recupping was accomplished without heat-treatment, which of course is a frequent source of trouble with rivet-sets of carbon tool steel.

Bearcat is an ideal tool steel for the manufacture of rivet-sets because of its superior shock-resistance. It is also well suited for uses where hot-work properties and easy machining are essential.

BEARCAT'S BIG FEATURES

1. Super shock-resistance
2. Deep-hardening . . . in air
3. Machines easily (Brinell 197 max)
4. Low distortion in heat-treatment
5. Good hot-work properties
6. Easily carburized for long wear

Typical Analysis

C	Mn	Si	Cr	Mo
0.50	0.70	0.25	3.25	1.40

In addition to being used for rivet-sets, Bearcat is ideal for such hot- and cold-shock applications as chisels, punches, hot headers and gripper dies. It has many other uses, too — master hobs, engraving dies, die-casting dies, and short-run dies used in cold-forming, blanking and bending.

You'll be well pleased with the service life obtained with Bearcat. We stock Bearcat in our mill depot. Or you can obtain a supply through your local Bethlehem tool steel distributor.

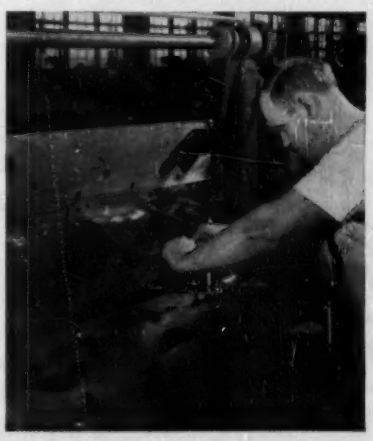
BETHLEHEM TOOL STEEL ENGINEER SAYS:

Use Care When Hardening Hot-Work Tools

Although hot-work tools can be hardened to Rockwell C-56-60, there are hardly any applications where such hardness is beneficial. The majority of hot-work tools are used in a hardness range of C-41-44, or C-46-49. On new hot-work applications, a common mistake is to heat-treat to a hardness level which is too high for the application, with the result that rapid heat checking or breakage occurs.

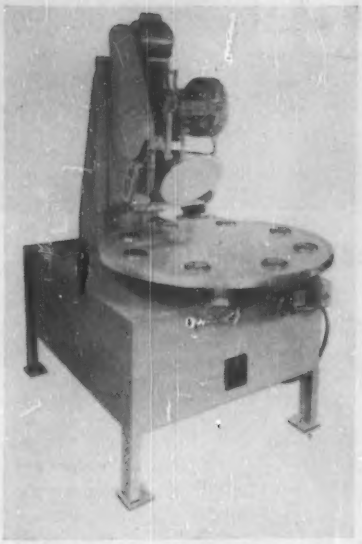
For example, put tools of our Hot Work 8 analysis to work at C-55 or higher, and chances are, they will fail prematurely. Yet these same tools, used at Rockwell C-52 or lower, will give outstanding service.

On every hot-work application the best hardness level must be determined by experience. There's always a compromise involved, as the highest hardness is best for wear-resistance, and the lowest hardness is more resistant to heat-checks. Our suggestion? To be sure of maximum service, don't overharden hot-work tools.



IT'S A-H5 FOR LONG PRODUCTION RUNS

This high-production die, made of A-H5, blanks and punches sheet steel of 0.180-in. thickness. A-H5 makes possible long production runs between grinds. It holds a durable cutting edge, and resists distortion in heat-treatment.

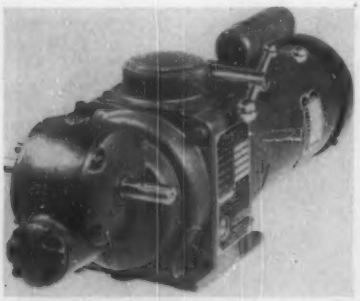


Semi-Automatic Machine Marks Flat Surfaces

Marking machine, designed for handling articles whose shape requires flat surface marking, is designated Model 25AD. Operating speed is variable from 30 to 60 spm. Multiple-station dial feed is hand-fed or adaptable to special feed or automatic discharge mechanisms. Workholding fixtures may be changed to suit size and shape of article.

Precision-molded printing elements are simple to mount, and provisions for changeover for variations in label legend can be incorporated. Printing area measures 11 inches left to right, 5 inches front to back.

Markem Machine Co, Keene 42, NH



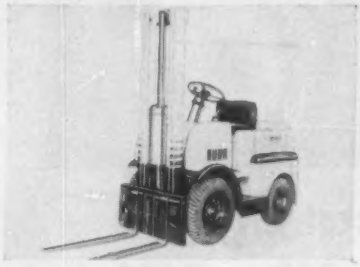
New Worm Reducer for Variable Speed Unit

More powerful worm reducer assembly is available as standard equipment with Graham infinitely variable speed transmissions in 1/6 and ¾ hp. Reducer can be furnished with double output shaft extension as shown, or with single shaft extension, horizontal or vertical, up and down. Several worm ratios are available including 5:1, 12:1, 23:1, 45:1, and 60:1, providing a wide range of speeds from 550 rpm to 0 down to 10 rpm to 0.

Worm gear is of phosphor bronze. Worm is alloy steel, hardened and ground. Oversize ball bearings support worm and worm gear shafts and are designed to take heavy thrust and overhung loads. Spring-loaded oil seals replace felt seals used in earlier model, and center distance between shafts is increased 60%.

Entire assembly of reducer, variable speed transmission, and motor is mounted with only four bolts. All speeds are available at the turn of handwheel. Micrometer control is standard with transmission. Other features include built-in overload protection, straight-line speed adjustment, wide choice of built-in motors including explosion-proof, and many types of controls including remote electrical, remote pneumatic, and hydraulic.

Graham Transmissions, Inc, Menomonee Falls, Wis



New Models of Buda Lift Trucks

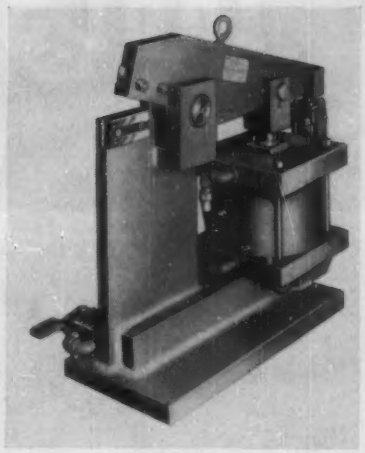
Buda announces the development of pneumatic-tire fork lift trucks—the FTP40-24 (gasoline) and FTPD40-24 (diesel).

Rated at 4000-lb capacity at a 25-in. load center, the trucks offer features that assure fast handling and low maintenance. Included are: full-vision instrument panel, automotive-type single-lever gear shift mounted on steering column; finger-tip flip-over parking brake; quick-change heavy-duty clutch; full-floating self-energizing brakes; and center-point steering.

Gasoline unit is powered with Buda 4-cylinder, 49-hp engine. The other is powered with a 4-cylinder, 40.5-hp diesel engine. Engine parts are 85% interchangeable.

Units are available in five standard mast heights with lifts of 72, 84, 108, 114, and 120 in. Both models are available with a torque converter at additional cost.

The Buda Co, Div of Allis-Chalmers Mfg Co, Harvey, Ill



Bars of 1¼-in. Diameter Cut With Air-Operated Shear

Air-operated shear cuts cold ferrous and non-ferrous bars up to 1¼-in. dia. Unit is reported to weigh less than half and occupy one-quarter of the floor space of conventional motor-operated shear.

It operates from any standard air supply or compressor at pressures from 60 to 125 psi — has no motors or gears to maintain.

Shear is recommended for cutting bar or flat stock in general production work, processing light scrap in conjunction with baling press, cutting concrete reinforcing rods or cables, either in prefabrication operations or on construction job, and shearing sections for laboratory tests.

Unit has 6-in. knives with 4 cutting edges which can be adjusted by set-screws after grinding. Shear is operated by foot treadle, remains closed in safe position when not cutting. Overloading does not harm equipment since limiting factor is pressure in air cylinder.

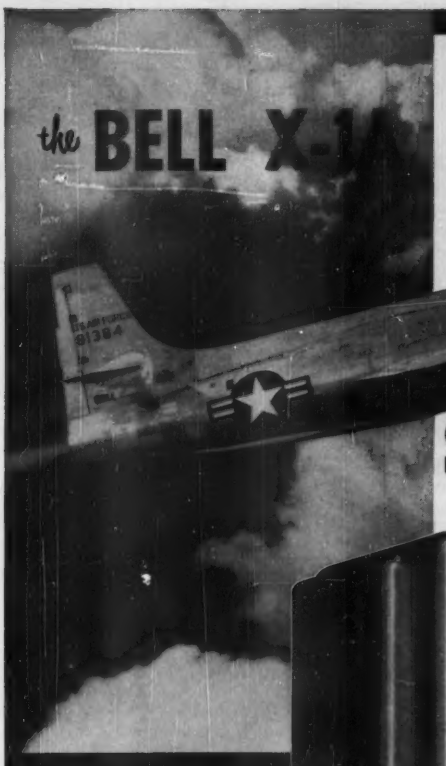
Operating air is lubricated and filtered before it enters valve or cylinder. Shear will cut 1-in.-dia cold mold steel at 80-psi air pressure with normal speed of 2 sec per cycle. Unit is 3 ft 2 in. high, 15 in. wide, and 36 in. deep.

Additional information is contained in manufacturer's bulletin 50-M.

Curry Air Shear Corporation, 941 Oliver Bldg, Pittsburgh 22, Pa

No. 103 relief valve has been tested and approved for a discharge capacity of 326,000 Btu at 30 psi, making it suitable for approximately 80% of all hot water heating installations.

Taco Heaters, Inc, 137 South St, Providence 3, RI



the fastest piloted airplane in the world . . . flying at more than 1650 miles per hour, or more than two and one-half times the speed of sound

BELL AIRCRAFT CORP.
BUFFALO, NEW YORK

SIDNEY *Heavy-Duty* LATHES

the fastest precision lathes . . . often saving more than two and one-half times on costs

photographed in the plant of BELL AIRCRAFT CORPORATION BUFFALO, NEW YORK

DON'T LET OBSOLETE LATHES PUT YOU OUT OF THE RUNNING

LET SIDNEY LATHES REDUCE PRODUCTION COSTS

ACCURACY

amazing accuracy assured. The Sidney Fluid Tracer Lathe on diameters and shoulder work repeats to extremely close tolerances as many times as desired.

PRODUCTIVITY

work formerly requiring long, tedious hours is now done in minutes.

SIMPLICITY

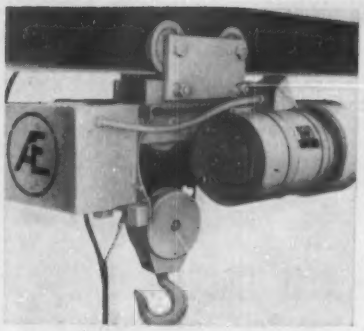
within 2 or 3 seconds Sidney Fluid Tracer Lathes can be converted to standard lathe operation and vice versa.

Write for bulletins

THE SIDNEY MACHINE TOOL COMPANY — 50th Year — AMERICAN INDUSTRY — SIDNEY • OHIO

THE SIDNEY MACHINE TOOL CO. • SIDNEY, OHIO

Builders of Precision Machinery since 1904



Electric Hoist Has Welded Steel Chassis

Lo-Head electric hoist, with welded steel chassis, is made in two- and three-ton capacity models. While retaining basic balanced design — drum on one side, motor on the other—it incorporates latest developments.

In addition to lightweight welded-steel chassis, unit features heat-treated alloy steel straight-line 3-reduction spur gears, automatic Westing heavy-duty lowering brake; heavy-duty hoist and crane motor; single-speed pushbutton control; completely shrouded; all-steel safety bottom block; ball bearing sheaves; and hook carried on anti-friction thrust bearing.

American Engineering Co, Aramingo Ave and Cumberland St, Philadelphia 25, Pa

Fork Lift Trucks Are More Compact

New series of compact gasoline fork lift trucks with high power-weight ratios is announced by Yale & Towne. Called the G-52 Series, trucks are available with pneumatic or solid tires in 2000, 3000 and 4000-lb capacity models.

Typical example, the 2000-pounder can negotiate a right-angle corner in a 57-in. aisle or right-angle stack in 112-in. aisle. Built on a 43-in. wheelbase, its over-all length is 72 in. Height to top of steering wheel is 50½ in., and to top of channel as low as 68 in. Powered with a 25-hp engine, it reaches a top speed of 8 mph through a transmission with two speeds forward and two speeds reverse, with speed controlled by governor. Directional control gear shift is located on steering column.

All-round visibility is reported exceptionally clear with cowl high enough to provide protection but low enough to permit driver to see forks and load. Engine exhaust is through Yale's specially designed muffler which eliminates heat concentration.

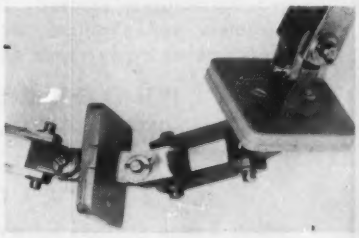
Lift speed without load is 55 fpm; with full load, 50 fpm. Lowering speed ranges from 65 to 75 fpm. Low hydraulic pressure gives positive control action.

Lift is actuated by piston-type Yale lifting cylinder equipped with drain back line. Tilt is actuated by two double-acting piston cylinders with an unloading valve to eliminate possibility of hydraulic voids in tilt cylinders.

Elevating fork carriage and telescopic channels are each mounted on heavy-duty rollers mounted on sealed ball bearings. On standard models channel height is optional at 68, 83, or 90 in. With telescopic lift, maximum fork height of 144 in. is possible.

Brakes are heavy-duty hydraulic type mounted on banjo housing completely inside wheel. Positive oil seal protects them from grease. Hand-operated parking brake, through mechanical linkage, operates same brakes. Controls are all located within convenient reach of the driver.

The Yale & Towne Mfg Co, Philadelphia, Pa



Tube-Veyor

Totally enclosed bulk-material-handling conveyor features two-directional chain to convey in any direction. Bulk material is conveyed through square tubular section by means of two-piece spaced metal flights.

Important features reported are: two-piece flight which can be replaced without disassembly of chain; square tubing which gives maximum surface contact; high-graphite cast iron furnished as standard flight material; can operate in more than one direction; any number of feed and discharge points; handles materials at high temperatures; positive material flow.

Prab Conveyors, Inc, 19815 East Nine Mile Road, St Clair Shores, Mich

Grinding and Checking Fixture

The Al-Maur master grinding and checking fixture reportedly makes it easy to grind and check tools, gages, and similar parts requiring small close-tolerance radii. Fixture grinds all angles from 0 to 180° and radii as small as 0.01 in. to tolerances as close as 0.0001 in.

It is claimed that the fixture utilizes theoretical principles and mathematics which even the best toolmakers have found difficult to apply in everyday shop practice. It consists of a hardened and ground steel base and removable steel body. The base has a hardened and ground and lapped bushing and two hardened and ground stop pins project from its top surface. A hole in the bushing establishes the zero point for the base and permits the body to be relocated easily.

Body has tapped holes for ease in mounting workpiece. The left edge serves as a fixed guide rail—on the right edge is hinged a 3-in. sine bar with a 2.000-in.-dia roll on one end and 0.375-in.-dia roll on the other end. These two guide rails, together with the large roll on the sine bar, constitute a continuous master form for any required angle or radius.

The fixture is shown utilizing the fixed guide rail of its body against the left-hand stop pin of its own base, as work is brought into contact with grinding wheel on an ordinary surface grinding machine.

DeSoto Tool Co, 2250 E Nine Mile Rd, Hazel Park, Mich

Taking the wheel of Hudson Motor Car Co.'s "Italia," N. K. VanDerzee, V.P. in Charge of Sales, explains:

How a new Hudson avoids traffic problems!

"Here is the new *Italia*—a look into the future and the latest member of the Hudson family which includes the Hornet, the Wasp, and the Jet," says N. K. VanDerzee.

"But new design naturally creates new traffic problems—in the factory. It's a big job to prevent parts shortages from stalling assembly lines. Air Express is a tremendous help.

"As our Traffic Department puts it: One phone call, and it's a load off our minds. Air Express delivers in a matter of hours. This dependable speed gives us the safety margin we need to keep production rolling. We handle about 2,500 lbs. a month by Air Express. Naturally, we're thinking about speed. But our records show that most of our Air Express shipments also *cost less* than they would by any other air service!

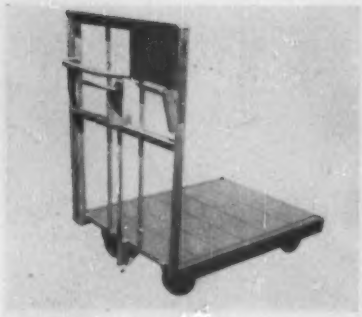
"Add to this the country-wide coverage and Air Express' ability to pinpoint shipments in transit, and you have some idea of why our Traffic Department turns to Air Express for our most urgent traffic.

"We in Sales are proud of our reputation for on-time deliveries of new cars. In large part, we owe that reputation to our Traffic Department—and Air Express."

It pays to express yourself clearly. Say Air Express! Division of Railway Express Agency.

Air Express

***GETS THERE FIRST** via U.S. Scheduled Airlines*



Four-Wheel Dragline Truck

Dragline truck is available in two styles—one for in-floor dragline conveyors and one for overhead dragline conveyors. Design features include adjustable drop pin which makes engagement and release from dragline easy; deck constructed of tongue and grooved kiln-dried hardwood protected on all four sides by structural steel; all wheels are rubber-tired with metal hubs; sealed bearings in both caster and main wheels require no periodic lubrication; swivel action of caster operating on two rows of balls running in hardened raceways.

Lewis-Shepard Products, Inc, Dept R-46, Watertown, Mass

Unit Makes Both Regular and Superficial Hardness Tests

Kentrall hardness tester makes both regular and superficial Rockwell hardness tests. Instrument is said to be the first designed to make tests utilizing all scales.

In its dual function unit makes all regular Rockwell tests (60, 100, and 150 kg loads) and superficial tests (15, 30, and 45 kg loads) with any suitable standard C, N, or ball indenter. Results show on direct dial gage with single numerical scale.

Minor and major loads are applied by dead weights. Stops inserted on sides of column facilitate changes in test loads. Major load being used is indicated by location of stops.

Such controls as elevating-screw handwheel, gage-setting bezel, load-tripping and load-lifting mechanism, are located in front side of base. Leveling screws built in the three-point base insure stability. Standard equipment supplied with each tester includes all weights for regular and superficial testing, 1/16-in.-dia steel ball indenter, 4 anvils and 8 test blocks. Price is about $650.

The Torsion Balance Co, Clifton, NJ

Ball and Roller Bearing Radial Play Gage

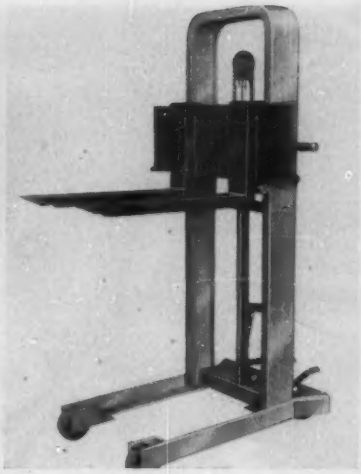
Constant-load gage was designed to measure assembled roller and ball bearings for radial play between outer and inner races. Dead-load pressure is used instead of spring pressure to give constant pressure on races. Air is used to relieve weight pressure while inserting bearing. Fully adjustable to measure three sizes of assembled bearings ranging from 1 to 5 in. outer race OD.

Operator slips bearing over hardened steel pressure shoe in center of open bearing nest and closes latter with cam lever. When left-hand lever is pulled, pressure shoe exerts predetermined downward pressure on bearing; vibrator settles all balls or rollers in their races, and operator reads dial indicator reading.

Operator then releases left-hand lever and pulls right-hand lever. Pressure shoe exerts similar pressure and vibrator settles balls or rollers, and operator notes indicator reading. Difference between two readings, shown in increments of 0.0001 in., is amount of radial play.

Gage can be made automatic or semi-automatic through addition of Federal Eccentricator and power units.

Federal Products Corp, 1144 Eddy St, Providence 1, RI

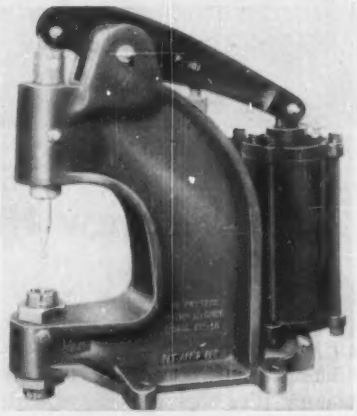


Hydraulic Lifts

Hydraulic lifts may be used in machine shops to lift boxes and material from one machine to another, to lift dies to press height and to support large overhanging pieces of material. There are 20 basic models—platform and fork lifts are available in both manually and electrically operated models. Capacity of all lifts is 1000 lb.

Illustrated is Model M266 which has a lifting height of 66 in. Over-all height is 80 in.; length of outriggers 23 in.; forks adjustable from 8 to 32 in. without use of screws or bolts; fork length, 26 in.

Lee Engineering Co, Pawtucket, RI



AIR-POWERED RIVETER will clinch everything up to 1/2-in. tubular steel rivets. Unit has rugged air cylinder delivering over two tons of pressure, taking maximum of 150 psi from normal air supply lines. With one-inch stroke, machine may also be used for stapling, light punching, knocking out rivets. Semi-portable, it weighs 60 lb ***—Robinson Products, Inc, 16550 Wyoming Ave, Detroit 21, Mich***

4500 per hour per machine!

You can't beat Revere Free-Cutting Brass for speed

The mounting nuts shown here are made by the Fischer Special Mfg. Co., Cincinnati 6, Ohio, out of Revere 9/16" hexagon Free-Cutting Brass Rod. Output is 4500 per hour per machine. This phenomenal rate of production is due to special adaptations of standard machines according to Fischer designs and the high quality of Revere Rod. These two important factors enable Fischer to compete price-wise with nuts produced by other methods.

Fischer nuts are chamfered and countersunk on both sides, have no burrs, and are made in sizes from 1/8" to 1-1/16", in various designs, such as hexagon, cap, thumb, spark plug terminal, lighting fixture. As a further indication of the efficiency of the Fischer operation it can be reported that during 1953 the company averaged 244,897 pieces per running hour.

If you machine brass, look into the virtues of Revere Free-Cutting Brass. See the nearest Revere Sales Office.

FISCHER WAFER or mounting nuts, made from Revere 9/16" Free-Cutting Brass Rod at a rate of 4500 per hour.

Revere Free-Cutting Brass Rod has speeded production for many firms, and saved them money.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, New York

Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y. Sales Offices in Principal Cities, Distributors Everywhere

SEE "MEET THE PRESS" ON NBC TELEVISION, SUNDAYS

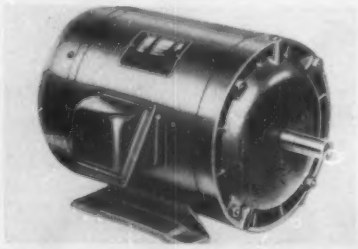
Hard-Facing Coatings With Metal Spray Unit

Metal spray unit was designed for applying hard-facing coatings in powder form. Designated Model C, Spraywelder is adapted to application of Colmonoy nickel-base wear- and corrosion-resistant hard-facing alloys to steel, stainless steel, and some cast iron and copper alloy parts by the Sprayweld process. Powdered alloys are first applied by spraying and then fusion-bonded to part by heating with oxy-acetylene flame.

Components are mounted on crackle-finished panel that is wall or pedestal mounted, including 3-lb aluminum pistol, chromium-plated copper hopper, a cast brass carburetor, an air regulator, an air filter and suitable oxygen, acetylene and powder hoses and fittings.

Pistol has gas-mixing design which provides maximum operation safety. Torch tip and cap have been redesigned to give additional strength and provide positive seating of tip on head.

Wall Colmonoy Corp, 19345 John R Street, Detroit 3, Mich



Howell Electric Motors Meet NEMA Standards

Howell has announced a new line of Series 100 re-rated polyphase motors in the 1 to 3-hp class. Motors are built in new frame size to horsepower standards set by NEMA.

Frames are of rolled steel and end plates of cast iron; 50% more contact area between cooling air and active materials assures maximum ventilation. Copper rotor construction has been retained.

First motors offered in the line are open, drip-proof and totally enclosed, fan-cooled types. Both are available in 182 and 184 frame sizes, rated at 1, 1½, and 2 hp at 1800 rpm; 1½, 2, and 3 hp at 3600 rpm, and ¾, 1, 1½ hp at 1200 rpm.

Drip-proof motors have bearing shields; space is available for a' most any standard bearing. Bearings are locked on shaft and in end plate; inside grease caps are standard.

Fan-cooled motors retain essentially the same contours as open motors. External fan is enclosed by pressed-metal guard; split-hub-aluminum fan is easily removed. Cartridge bearing enclosures allow complete disassembly without exposing bearing.

Howell Electric Motors Co, Howell, Mich

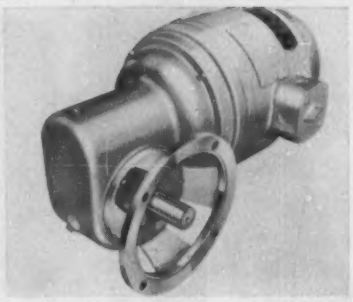
New Model of Magnus Bearing Washing Machine

Model RT ball bearing washing machine is the batch type with loading and unloading at same location—consists of cabinet, spray system, pumps, solution tank, rotating cones, and filtering system. Washing and rinsing operations are performed at the same time. Specially designed cones, complete with removable extension spindles, are installed inside.

When fully loaded, machine holds four bearings, placed on cones and on cone extensions. By means of Magnus rotating system, inner races of bearings rotate 360° in either direction. Outer race of bearings does not rotate—it is held in fixed position by self-adjusting spring-loaded holding device.

All inner and outer surfaces of bearings are uniformly cleaned with filtered cleaning solution through nozzles located above and below bearings. Model RT has capacity of 500 bearings per day.

Equipment Div, Magnus Chemical Co, Inc, Dept AM, Garwood, NJ

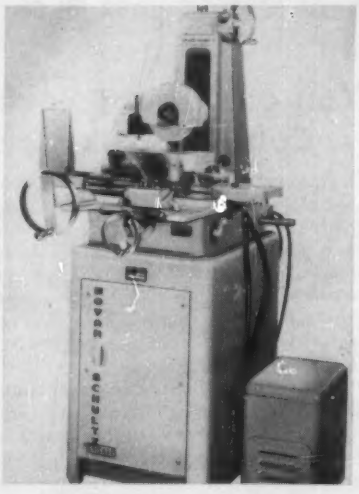


Fluid-Coupled Worm Reducer

Unit features fluid-cushioned starting in conjunction with compact, worm-type speed reducer. It is especially adapted to powering loads that require smooth, gradual acceleration. Unit is also said to provide unusual compactness in comparison to helical gear reducers.

Worm reducers are available in the following horsepower ratings and frame sizes: 1/3 and ½ hp (66W frame); ¾ and 1 hp (204W frame); 1½ hp (225W frame); 2 hp (254W frame). Speed reductions from 24 through 140 rpm are offered. Reducers can be ring- or foot-mounted as desired.

Reuland Electric Co, Alhambra, Calif

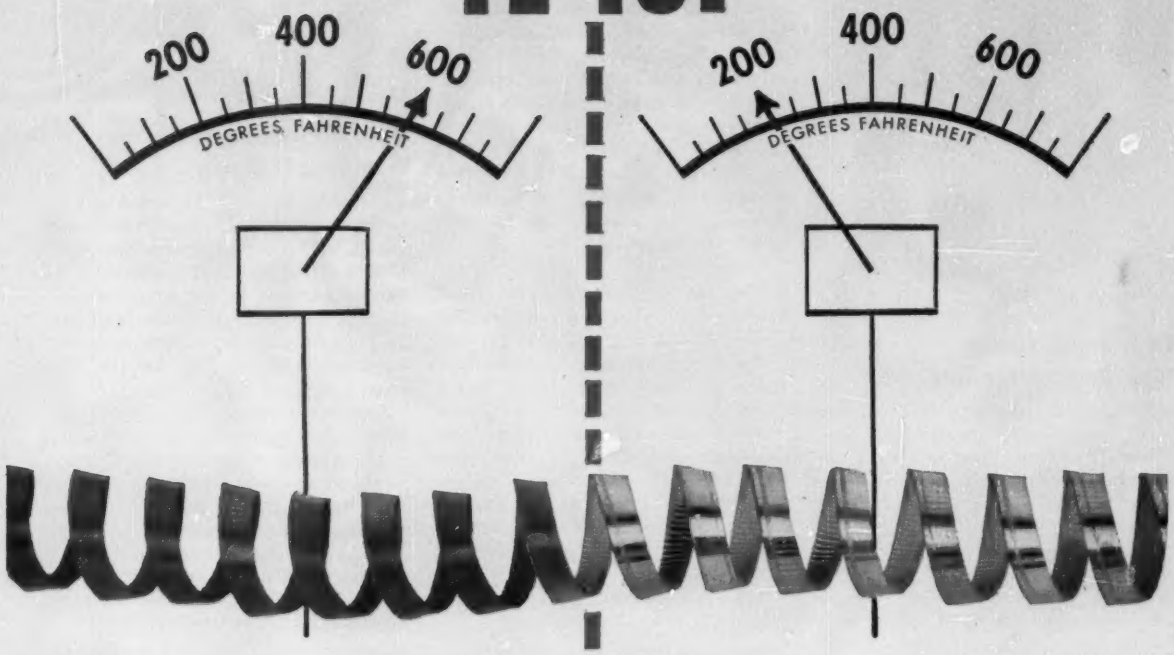


Boyar-Schultz Surface Grinder Has Hydraulic Table Action

Boyar-Schultz 6x12 surface grinder is now available with hydraulic longitudinal action. A new hydraulic valve affords perfect reciprocating movement, according to the manufacturer. Machine can be changed from hydraulic to hand feed and return in a few seconds.

Boyar-Schultz Corp, 2110 Walnut St, Chicago 12, Ill

TL-131



NEW coolant by Johnson's Wax reduces chip temperature 400°

On a lathe, using a conventional coolant, the chip temperature was 600° F. producing a burned and blue chip. Without stopping the lathe, the coolant was changed to new Johnson's TL-131. Immediately, the chip temperature dropped to below 200° as proven by the bright, natural color of the chip and by touch.

In repeated tests, new TL-131 was compared to all major brands of conventional coolants. In every test the exceptional cooling properties of TL-131 caused costly blue chips to become bright. In every instance TL-131 outperformed other coolants.

Coolness means Johnson's TL-131 can reduce costs in your shop. TL-131's *special chemical ingredients* dissipate frictional and work heat to give you longer tool life, less down time, finer finishes, increased production and greater profits.

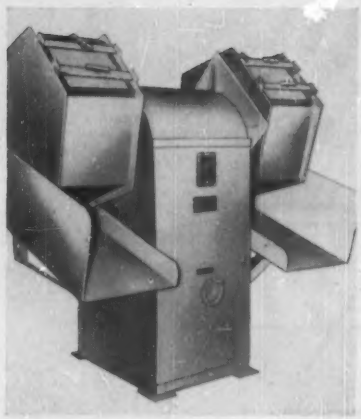
TL-131 Is Economical

This new water soluble coolant is used diluted 40 to 1 with water. And, TL-131 is especially recommended for cutting hardened steels at high speeds. It does not contain sulphur or chlorine.

Try Johnson's TL-131 in your shop

Try TL-131 on the toughest job in your own shop. You MUST be satisfied because TL-131's outstanding performance is guaranteed. A test is easily arranged. Simply contact your local Johnson Distributor or write to:

Industrial Products Division · Dept. AM-8
S. C. Johnson & Son, Inc., Racine, Wis.



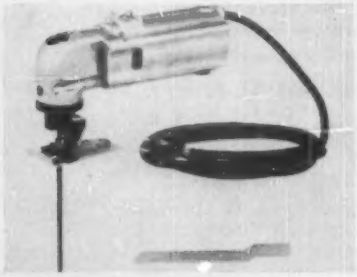
Twin Barrel Finisher With Doubled Capacity

Super twin precision barrel finisher with 4-cu-ft capacity has variable speed drive from 12 to 36 rpm. Construction includes sealed ball bearings throughout, heavy construction, water-tight pushbutton, magnetic starter, hexagonal steel burring barrels constructed from 10 gage steel, welded watertight, and simple gasketed side covers attached with two screws.

Model illustrated has moveable chutes which can be tilted to the rear to drain off liquid and front to discharge load. In rear position, chutes act as safety guards. Tote boxes can be furnished in place of moveable chutes if desired. Barrels can be lined with vinyl plastic.

Motor is ¾ hp, 220/440 volt, 3 phase.

Rampe Mfg Co, 3320 St Clair Ave, Cleveland 14, Ohio



Nibbler Now Converts To Production Saw

Portable Fenway nibbler, which utilizes punch-and-die action to cut metals up to 14 gage, can now be converted to high-speed production file or saw. In addition Fenway engineers have designed a new two-piece nose which cuts maintenance cost of tool.

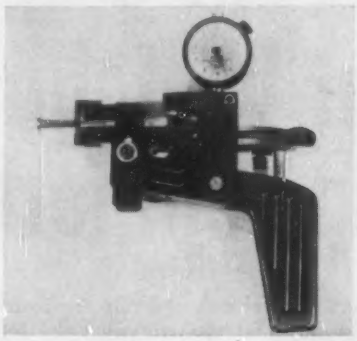
Conversion of the nibbler to a file or saw is done by attaching an adapter to the modified nose and replacing driving cam with another of longer stroke. Chuck readily accommodates either file or saw. As a file or saw, the nibbler can be used on any metal or wood surface, curved or flat. As a nibbler, the tool will cut metal and follow a scribed line and will work to a minimum radius of ⅞ in.

Older one-piece-nose nibbler can be modified to permit use of new adapter and two-piece die holder.

Fenway Machine Co, 263 N 23rd Street, Philadelphia 3, Pa

Seilon, an unplasticized, or rigid, polyvinyl chloride is a light, strong, corrosion-resistant material for lining acid or chemical tanks, for acid ducts or vents, acid trays, pipes, valves, pumps, and many other corrosion-proof applications. Available in sheets and plates; tubes, pipes, rods, and bars produced by extrusion. Material can be sawed, shaped, sanded, or drilled, stamped, turned, or cemented, welded formed, or blown like glass.

Seiberling Rubber Co, Akron 9, Ohio



Measurement Gage Checks Undercuts

Pistol-grip measurement gage is used in toolmaking and by inspection departments to measure O-ring grooves, deep holes, tapers, recesses, inside spherical radii, and out-of-round areas. It will measure to 0.0005 in. but closer readings may be checked. Gage is shaped like pistol for ease of holding and has dial gage mounted on top calibrated in half-thousandths.

Measuring tips are of hardened gage steel, actuated by pressing down control lever with thumb. By release of lever, tips expand and record dimension of location being checked. Gage offers continuously variable ID measurements from 0.250 to 2.000 in. with standard tips. It is fully adjustable and self-centering.

Mueller Laboratory, 239 W Maple Ave, Monrovia, Calif

Hand Tachometer Reads From 50 to 5000 rpm

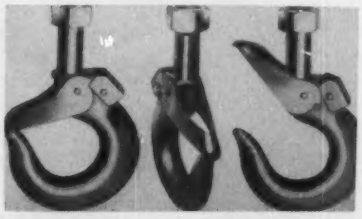
Hand tachometer instantly shows revolutions per minute of revolving shafts in ranges of 50-500 and 500-5000; shift between high to low ranges is made by a quarter turn of control button. Instrument indicates feet per minute of moving surfaces by substituting a disk for the tips used for giving rpm.

Centrifugal, mechanical operating mechanism is unaffected by temperature changes, stray electrical currents, or magnetic conditions. Special stop button device permits holding dial pointer at measured speeds after instrument has been disengaged from work shaft or moving flat surface. Unit, in carrying case with accessories, is priced at $62.

Jones Motrola Corp, 432 Fairfield Ave, Stamford, Conn

Electroflo solenoid-operated valve provides automatic on-and-off control of flow (water or air). Pilot action provides large flow capacity. Available in ⅜, ¾, and 1¼-in. pipe sizes.

Hays Mfg Co, 814 W 12th St, Erie, Pa

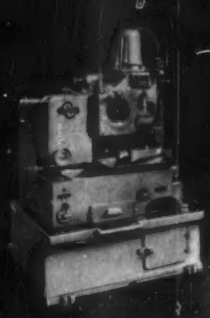


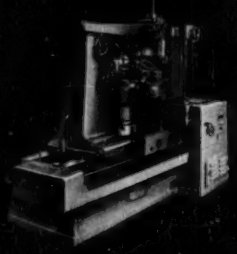
New Safety Hook

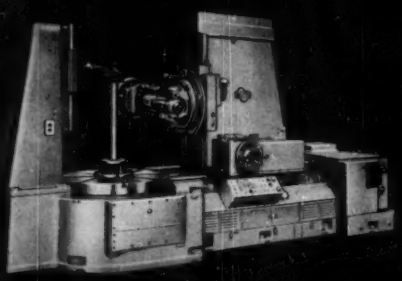
Safety hook developed by Coffing Hoist is said to not only offer greater safety to both men and equipment but also to be simple and convenient enough so hoist operators will make full use of safety locking feature. Once hook is engaged, stamped steel latch swings down and is securely held in place by lock under spring tension. Slight pressure on release unlocks latch, and spring tension on release holds latch open.

Latch is designed to allow full and unobstructed use of hook's large throat opening.

Coffing Hoist Co, Danville, Ill





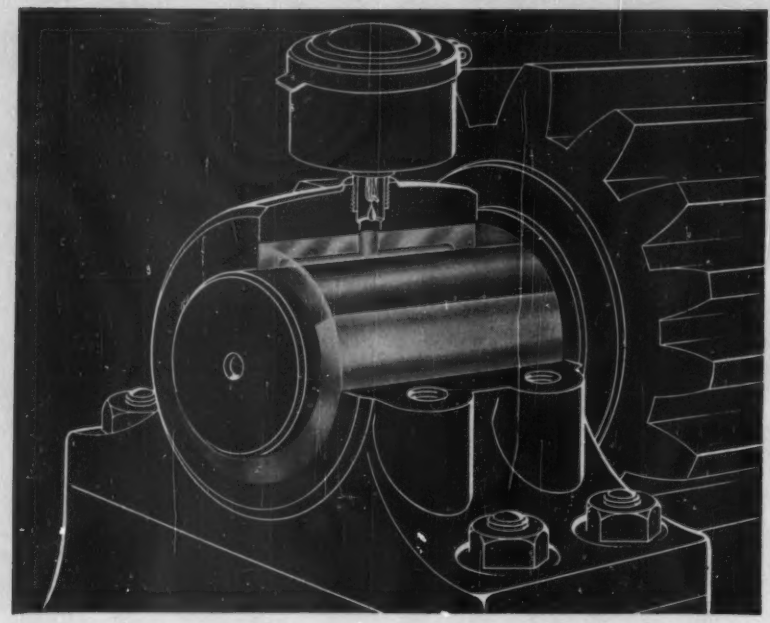


GEAR SHAPERS

GEAR HOBBERS

CUTTERS

MASCHINENFABRIK LORENZ ETTLINGEN / GERMANY



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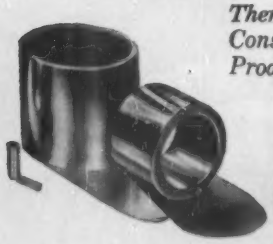

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ROUND TABLE Discussion

SETUP STEW

Is there danger of friction between union and non-union men if the Master Mechanic's Office insists on doing special setup work in the shop? What's the best way to handle it?

WE WONDER as we read this debate of Ed and Al if the question is actually the exact question of setup, or if it is the authority question. We have seen this very thing happen in several plants where the scare of union trouble was used to cover up those things which a foreman did not like. He, perhaps due to his individual makeup, felt that he was being cheated and overlooked. So to counteract this feeling he blows off steam about the big bad wolf around the corner.

Now it is true that some shops are so full of dynamite that a little spark set off by non-union men doing union work would blow up the place and cause serious trouble. However, too many times it is the foreman who actually hits the flint against the steel making the spark. His comments regarding the situation are eaten up by unionized members. They think of the foreman as a part of the company management; his actions are the actions of the company to them. After all, if the company "front" thinks there should be trouble, then it must be sanctioned by the company to have trouble.

What a fallacy—but it is not so far from the truth. The one thing that we have never been able to get across to our foremen is that in the eyes of the worker, *he is the company*. His action, words, and deeds are the company to them. We, in top

"P-U-U-LEEZE!"

management, fail to get this across to our foremen and, in particular, the young foremen. We do not stress this factor. Perhaps we leave it to someone else to do, and it just isn't done. The line of action thins out in large companies as we go down the ladder from the top. Things are left undone because no one takes the time to do them or to check them.

But the problem seems to be the setup men from the master mechanic's office versus the mere setup men in the shop. Now if this company were well organized, and clear lines of authority had been established, the question would never have come up. But it has, and we should discuss its danger. First, the men employed by the master mechanic's office should be trained in a much broader scope than the specialist in the shop. They must know more about total shop equipment, its use, its need for care, and how to repair it, if necessary.

Now it is not uncommon for companies to have the setup department attached to the master mechanic. The reason is that in this way trained and skilled men have the opportunity to look over the machines and to check them before they are placed back in production. Why is this important? Because this preventive maintenance principle is worth thousands of dollars. It prevents breakdowns in the middle of runs. It reduces maintenance cost, and keeps machines in better condition to turn out quality products.

Production personnel do not think of this, for they are being hounded for pieces—not to take care of equipment. True, they lose sight of the goal when they run a machine into the ground, but again the principle of machine upkeep is not taught them. Generally speaking, a shop using setup men from the master mechanic's office has better equipment and turns out better products. This is not always true; I know of shops where the other system of departmental setup men is used, and they do remarkably well in both production, quality, and good machines. But the secret is the foreman. He understands the principle upon which he can balance his forces and keep the proper amount of production flowing without seriously damaging equipment.

When the proper rules and regulations are set down in black and white there is seldom a conflict between union and non-union employees. Job descriptions are established and weighed. Those jobs which belong to service are often non-union. Setup is sometimes considered that, if it

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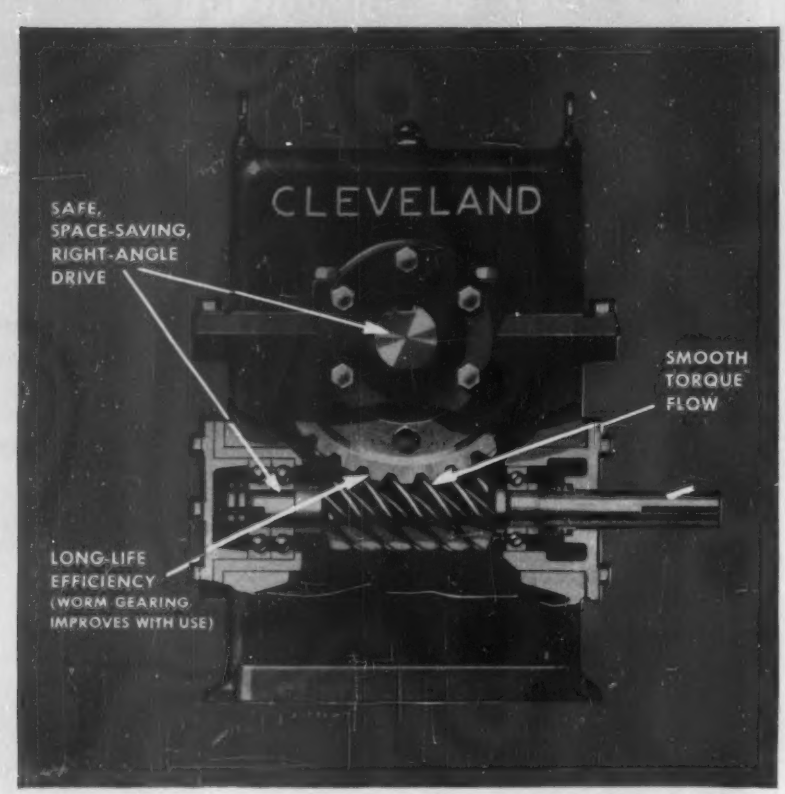
Why WORM gear?



Cutaway shows compact interior design and construction of a typical Cleveland worm gear speed reducer.

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Speed Reducers

is so developed by the master mechanic and his department.

Frankly, the scare that Al is using is a hoax unless this shop is sitting on a keg of powder and Al has the fuze in his hand to light. His attitude can cause it to blow up.

Charles D Townsend
West Hartford, Conn

THIS PROBLEM of the master mechanic coming into the shop and interfering with the work of the setup men is just one particular example of a problem which exists on every level in every shop and in every business and social organization as well. It results from a lack of understanding and appreciation of human effort.

Nobody works at a job for the sake of working; it is a necessary part of our existence. It is not sufficient that we have food, clothing, and shelter. We are not animals. It is the desire of each individual to have the esteem and consideration of his fellow men. There is a void in each of us that can only be filled by knowing that we are needed and wanted.

The amount of effort and enthusiasm a person has for his or her work is directly related to the amount of respect and regard the organization has for the energy this person expends and the trouble he goes to to make every job a good job. It matters little whether a person is an executive, or a setup man, or a porter; each is part of the organization. They have each been selected for their job according to their ability. This ability is a part of them just as truly as their hand is a part of them. If a second person is permitted to step in and do the work assigned to them it is an insult to their ability. This is a very fundamental question and goes much deeper than any

"Isn't there a more modern way to select a new foreman than eeny, meeny, miny mo?"

question of union work being done by non-union men; it is a rank disregard of this person's skill and competence and a sure way to create ill-will and lack of interest in the job.

It is an unfortunate situation, but in some organizations the tools and machines are regarded as being more important than the men who run them. Maybe this is because the machines are more demanding than the men; stop the flow of power for a moment and the machine immediately stops driving, cut off the oil and the machine not only stops but shows its dissatisfaction by standing idle until it is compensated by receiving a new bearing. As the people who direct the destiny of industry become increasingly aware that the toiler in the ranks is fashioned of flesh and blood, bone and sinew, and possessed of a personality, and is above all an individual to whom his "self" or "ego" is the most important thing in the world, then we will have more and more harmony in the shop.

The solution in this case is for the master mechanic to respect the setup man's position. If he has a new idea that he would like to try out, let him explain it to the setup man who can then set it up for a trial. In this way they both know just what it is they are working toward. There is a good chance that the setup man can contribute some ideas of his own—something that would never be forthcoming if the master mechanic went over the setup man's head and antagonized him.

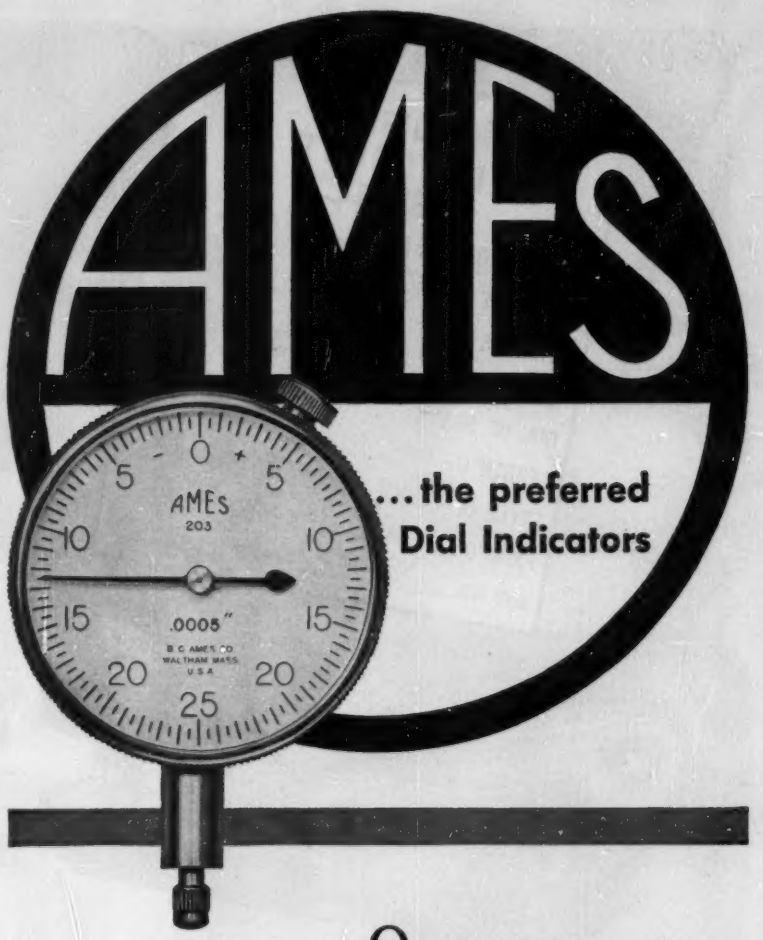
H G Koslow
Bronx, NY

DECIMAL DITHER

Which is easier for all-around shop use — decimals or fractions? Would the average shop man rather write or read a dimension as 33/64 in., or as 0.515625? Does the extreme accuracy of the decimal system counterbalance the familiarity of long-time use of fractions?

Intense standardization of methods and practices, such as using fractional systems of measuring, does rather tend to stultify the mental processes. It is suggested, in the case presented under the above title, that it is possible to dimension drawings in fractions of an inch without having to resort to decimals at all. This is very mysterious, and I would like to know just how it is accomplished in engineering manufacture.

In my own shop experience in the USA situations often arose when a dimension could not be expressed as



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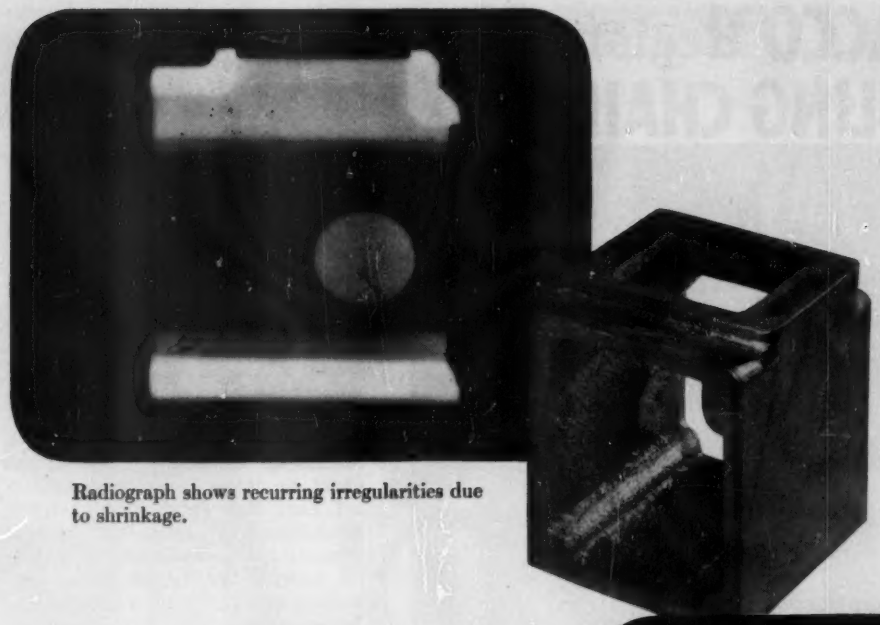
a fraction; for instance, the center distance of a pair of gears. However, to get back to my opening statement about standardization, it will be apparent to anyone who has visited countries that work on a purely decimal coinage, measurement of volume and length etc, that the local inhabitants are very poor at mental arithmetic. This is most notable in retail shops when the foreign visitor has totaled up his purchases mentally and converted the value into terms of his own coinage whilst the clerk is reaching for pencil and paper.

The USA and Britain work with the old British systems of length, volume, and weight on which to sharpen their mental faculties. The British go one further by giving themselves additional mental exercise with their peculiar system of coinage. Because of their close proximity to the European continent, where everything is decimal, the British machinist must also be conversant with the metric system. Some British aircraft factories now use drawings which have dimensions in inch-fractions, inch-decimals and millimeters. The men working with these drawings are of average intelligence and find no difficulty in coping with the three systems at one time. I'm certain that no American machinist would experience any difficulty. At the present time, I think I am right in saying that most USA ball race sizes are in the metric system of measurement. These must be stated on drawings to, at least, four places of decimals if the mating parts are to be sufficiently closely controlled for size.

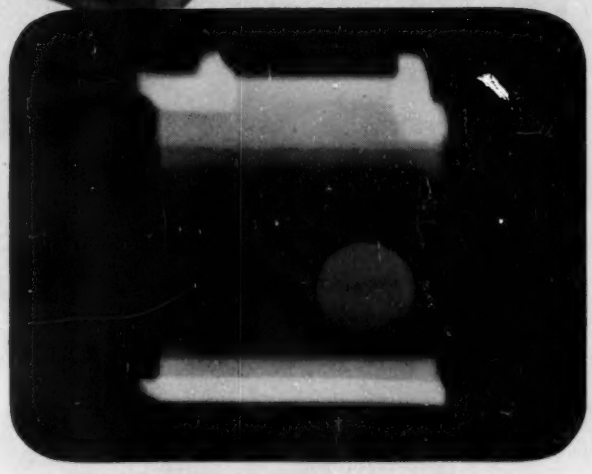
"Congratulations, Andy! I just heard from a confidential source about that nice, big, fat, secret raise you got last month."



Radiograph shows recurring irregularities due to shrinkage.

RADIOGRAPHY

puts the finger on a profit thief



A change in gating produced sound castings.

Shrink was a problem in casting this instrument housing of 355 aluminum. It looked like the yield would run low.

But radiographs of pilot runs put the finger on the cause—revealed a pattern of recurring irregularities. This suggested a change in gating which, when adopted, quickly corrected the difficulty.

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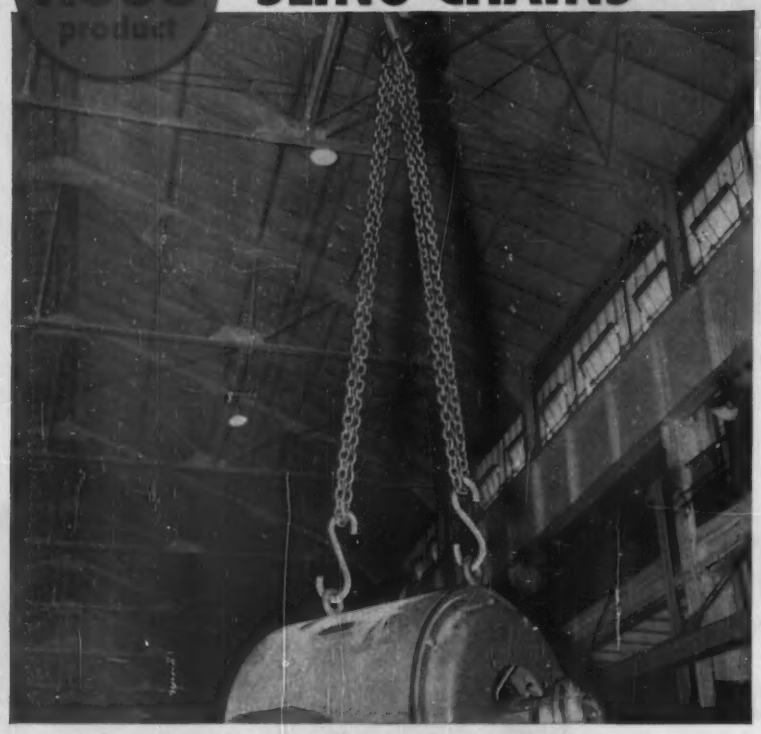

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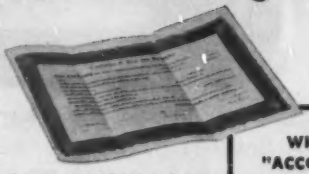

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There is no doubt that decimal sizes are easier for the machinist to work with; every measuring instrument, except the steel rule, is calibrated for decimal reading and some firms have used this fact when trying to maintain accuracy. By dimensioning some lengths in fractions and others in decimals it was possible for the draftsman to suggest which was an accurate dimension and those in which rule measurements would be acceptable.

The sooner we cease quoting sizes down to increments of 1/64 inch, the sooner we can all stop consulting conversion charts. Very few machinists can quote the decimal equivalent of all the 64th-inch sizes. As soon as a machinist consults a conversion chart, he ceases to produce work.

I have had experience of batch production of metric-(a decimal system) sized components in a British factory. We started out by converting all the metric dimensions to inch-decimals, and to do the job faithfully we had to carry all conversions to at least four decimal places. This meant that we were specifying the diameters of hot rolled bars in tenths of thousandths of an inch. The cries of anguish from the machine shop were loud and a state of mild chaos persisted for some time. We then decided that drilled holes and the like be specified in their original millimeter form. To our surprise, the shop accepted this without a murmur of complaint. Some time after we "went metric," machinists said that they preferred the metric system to the fractional inch because it was much easier to work with and yielded a much higher standard of accuracy, particularly when using a steel rule.

From my own experience of preparing component drawings from metric samples parts (copying!) it was much easier to get the right sizes

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of these parts by measuring with a metric rule. The metric micrometer is also very much easier to use than is the inch type. It seems to me that the millimeter graduations on a rule are about the smallest which can be seen accurately with average eyesight. Sixty-fourth-inch graduations are certainly too small for comfort.

One innovation which is likely to clarify the whole problem of when to use fractions and decimals of an inch is the recent publication of British Standard 308:1953 "Engineering Drawing Practice." This Standard is the most important guide book for draftsmen yet published, since it has been compiled in cooperation with USA Munitions Board Standards Agency and representatives of the armed services of Canada. The objects of the two conferences which the British Committee had with the two North American groups was to enable some unification of dimensioning practice to be obtained. I am not saying that British drawings will now be fully understood by North American engineers, but they should raise less queries than has been the case in the past.

The Standard is perfectly clear about dimensioning methods. For instance, decimal fractions must be used only with inches; instead of mixing feet in with the inches, a size will be written as 60.625 and not 5 ft, 0.625 in. The Standard also says that decimal dimensions must be carried to a sufficient number of decimal places to meet design requirements and that fractional and decimal dimensions may be used on the one drawing. If a drawing is dimensioned wholly in decimals, standard fractional inch sizes can be quoted in brackets alongside the

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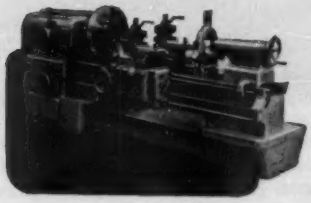

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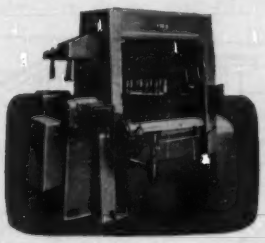

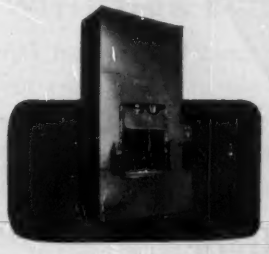

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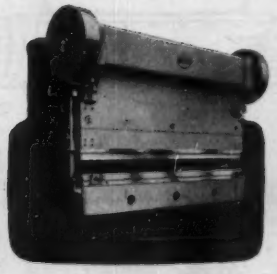
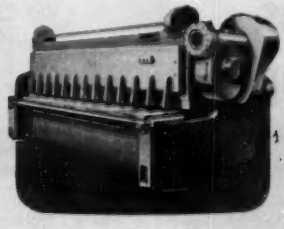
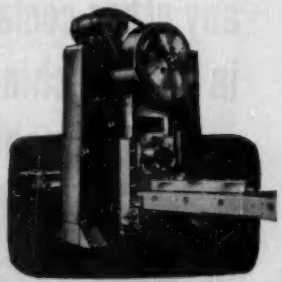
Stands **1108** and **1110**







INDUSTRIE-WERKE KARLSRUHE Aktiengesellschaft,
Karlsruhe, Germany

WE'LL BET YOU A STETSON

Lusol will outperform any other coolant in your machines in your own shop

Read about this...

decimal. This prevents the shop having to waste time with conversion charts, yet permits the intensively designed component to be dimensioned mainly in decimals.

Clifford T Bower
London, England

Suggestions or Extractions

Should a toolmaker be eligible to participate in a Suggestion Plan, or is it part of his job to produce new ideas and better processes?

IT WAS PROBABLY 1900 when Ed last let a new idea percolate through his skull, good old days when you were properly thankful that, out of the goodness of his heart, the boss gave you a job and from that day he owned you body, soul, and ideas. Whether you were an apprentice, a toolmaker, a draftsman, a foreman, or anyone else, your wages included any improvements you could devise in the product or means of production.

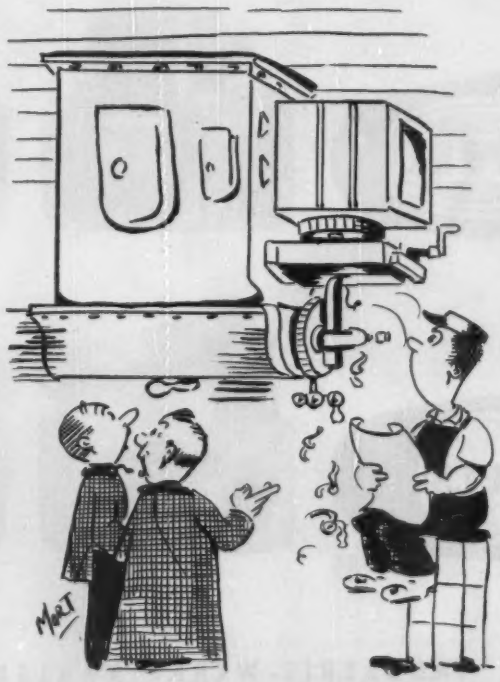
When a corporation trains apprentices, it is because it expects to get something out of it; certain loyalty from graduates of its school, men trained in its methods and policies, a source of known quality for its supervisors. But it cannot expect that all its apprentices will stay with it, and when they graduate, the gamble is won or lost, and apprenticeship no longer comes into consideration.

Ed should look at the prevailing conditions realistically. A toolmaker is paid according to a scale of wages generally based on those paid in the vicinity. It is immaterial where he learned his trade, as long as he can read drawings and translate the figures thereon into chunks of metal. Whether he learned as an apprentice in the same shop or as an apprentice in another shop or in the school of experience, his wages are the same. When business is bad, his source of knowledge may mean something, although many of us who survived the 1930 unpleasantness can testify to the contrary.

If a toolmaker then does something beyond what he is paid to do, why can't he cash in on it, as well as the machine operator in the next bay?

This is not merely an academic discussion, because quite a number of organizations have already recognized that anyone below the rank of foreman, or equivalent, is entitled to a reward for extra effort, and have received a number of suggestions, some of them very valuable. It is not the tag on a man's activities that counts, but how much he adds to the profit of the firm, and anything that may do this is worth while.

P P Fenaux
Lynn, Mass



"This shaper is used for taking off metal from the underside of machine parts."

VISIT A PLANT WHERE *Lusol* IS WORKING!

Talk with men on machines in which Lusol is the coolant—men on lathes, milling and contouring machines, grinders, drills, rollformers, cutoff saws. Lusol engineers are doing this all the time, so ask to visit a plant with them.

You'll see an unusually *clean* plant, because there's no oil in Lusol to burn and smoke. Machine cleaning programs built around Lusol make factories better, healthier places to work. Workmen like Lusol because it's easy on the hands and their clothes stay cleaner.

Because Lusol is an all-chemical water solution, it dissipates heat faster. You'll see machines working at higher speeds, producing more and better parts. Less downtime for changing tools, since cutting edges run cooler and stay sharp longer.

WITH THIS EVIDENCE

Ask for a trial of Lusol in your own plant—not a special run in just one machine, but on standard jobs on a variety of machining operations. The Lusol man will help you clean out the machines, install Lusol in proper concentrations and get the tests under way.

If Lusol doesn't show up better than what you've been using, we owe you a Stetson. Frankly, we don't expect to lose a hat; we've seen Lusol's fine performance in too many plants to doubt its ability.

TO MAKE A DATE WITH A LUSOL ENGINEER, MAIL THIS COUPON

F. E. Anderson Oil Co., Inc., Box 215, Portland, Conn.

Have your man call to discuss arrangements for installing Lusol All-Chemical Coolant in the machines selected for this test.

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COMPANY_____

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Send me the booklet, *Lusol Gets to the Point*

Order Zagar Collets and Collet Fixtures at These Low Prices

Zagar has a fixture for every collet tool application. Order NOW from your local tool supplier.

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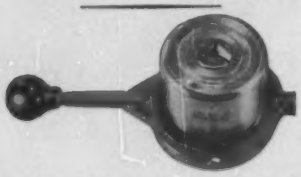

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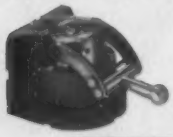

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Zagar TOOLS For INDUSTRY and SPECIAL MACHINERY

New Books . . .

PRACTICAL GEAR DESIGN — *By D W Dudley. Published by the McGraw-Hill Book Company, Inc, 330 West 42nd St, New York 36, NY. 335 pages, 6 x 9 in. Price $7.*

While this is a design text, it is written with the shop man in mind, because manufacturing methods and causes of failures are covered as well as geometry of gear design. Further, it shows how practical design must be based on the limitations and availability of machine tools and tooling for the job.

This is an exceedingly competent book, done with the assistance and advice of many experts in the American Gear Mfrs Assn as a result of Mr Dudley's long and active membership in committees of that organization. It also incorporates suggestions from many other companies than that of the author, although all conclusions are his own. Even manufacturing times are included for various processes, these presumably being based on GE practice, hence somewhat better than those obtainable by some smaller shops not so well equipped.

Chapters include trends, design considerations, formulas, materials, manufacturing methods, tool design, kinds and causes of failure, and special design problems — making the book a short handbook on gear making rather than strictly a design text. This is to be expected, because the author is supervisor of Gear Advance & Development Engrg for GE, hence deals with a variety of gear types on a broad scale in his daily work.

•

MACHINERY'S HANDBOOK [FIFTEENTH EDITION]—*By Erick Oberg and F D Jones. Published by The Industrial Press, 148 Lafayette St, New York 13, N Y. 1911 pages, 4½ by 7 in. Price, $9.*

Rapid growth of data in the technical field, the large number of new standards, the changes in engineering and manufacturing practice, and the advances in new materials and alloys place a heavy demand for space on present-day handbooks. As a result, the word "handbook" in its original sense has almost become a thing of the past. The 15th edition of Machinery's Handbook, however, re-

PRECISE MULTIPLE CUTTING . . . WITH ONE W&S TOOL cuts your production costs

Holes within holes—holes of multiple diameter, intricate profile, and great precision—can be bored in a single operation with a Woodruff & Stokes small cutting tool designed by specialists for your exact requirements. Holes from pin-point to ½" diameter—single or concentric, tapped or reamed, bottomed or through-cut—are made quickly and economically in the hardest metals with W&S tools.

If your production involves the precision machining of very small holes, let Woodruff & Stokes design into one operation a job that may now be costing you as many as five.

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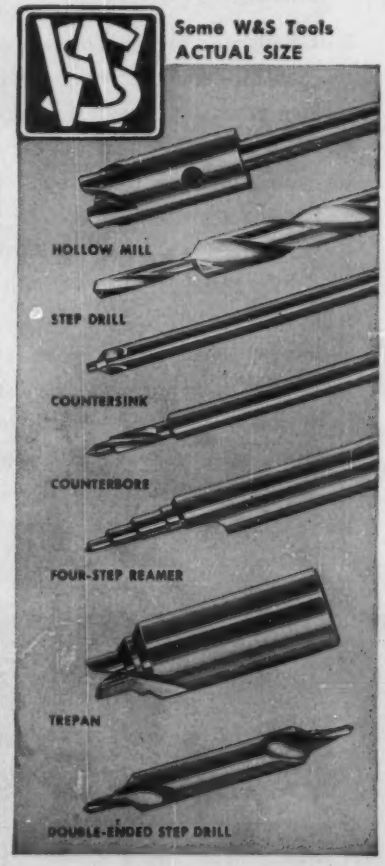

mains in size and format the same as its predecessors.

Of particular interest in the fifteenth edition are a revised and rearranged spur gear section and a new section on generated bevel gears. Featured in the spur gear action is an enlarged presentation of standard definitions and terms; formulas and tabulated data for readily determining the dedendums and root diameters for hobbing and shaping pre-shaved gears; data and information on fine-pitch spur gears, including tolerances for gear blanks, and data for enlarged pinions; and recommendations and tabulated data for obtaining the proper amount of backlash in various types of gears.

In the bevel gear section, a detailed presentation of the revised Gleason system of straight and bevel gears is included with formulas, charts, and step-by-step procedures for designing bevel gears for durability and strength. In addition, there are formulas and methods for determining thrust and radial loads, and a table of recommended bevel gear materials.

A new section on fine-pitch worms and worm gears has been added, and formulas are given for obtaining profile and pressure angle corrections for cutters and grinding wheels used to produce fine-pitch worms.

Changes in dimensions of American Standard square and hexagon bolts and nuts are summarized, with a table comparing the old and new across-flats dimensions. Complete tables giving the standard sizes and limiting dimensions are included.

Thread classes, thread form, allowances, tolerances, limiting dimensions, and preferred thread series of the American Standard general-purpose Acme and stub Acme screw threads are given in the extensive and detailed screw thread section.

The section on ball, roller, and needle bearings is new and gives in considerable detail and scope the descriptions, designations, ranges of standard sizes, boundary dimensions, and tolerances for standard antifriction bearings. Also outlined is the Anti-Friction Bearing Manufacturers Association plan for bearing designation. Standard minimum shaft shoulder and maximum housing shoulder dimensions for ball and cylindrical roller bearings are also given.

The milling cutter section now gives tables of dimensions and tolerances covering the various types of American Standard milling cutters, together with a table showing four types of setups for grinding clearance angles on cutter teeth.

McCASKEY TOOL CONTROL *pays for itself several times a year....* IN A SMALL SHOP, TOO

The many improvements and savings resulting from complete control of tools in the small plant of Lawler Automatic Controls, Inc., Mt. Vernon, N.Y. are described by James Lawler, Jr., Vice-President, in a recent article in IRON AGE.

Manufacture of Lawler thermostatic control valves requires a wide variety of standard and special tools for their 35 to 40 production employees. Production delays from missing tools formerly were frequent and tool expense was high.

Here are a few of the results secured with their simple McCaskey Tool Crib Control system, quoted from Mr. Lawler's statements:

- . . . tool crib service is much faster.
- . . . quick location of tools on production floor or in the crib saves an average of two hours a day of a machine operator's time.
- . . . faster crib service saves many hours of machine down-time.
- . . . time required by crib attendant to check tools in and out reduced 70 to 75%.
- . . . tool costs have been reduced from 35 to 50%.
- . . . breakage records make employees more careful about tool use and abuse and provide for quick replacement of damaged tools.
- . . . guesswork has been taken out of ordering and stocking tools through simple and accurate inventory and activity records.
- . . . tool hoarding and loss have been reduced, disputes between crib attendant and machine operators are prevented.

. . . the installation paid for itself several times over the first year and continues to be a profitable investment.

Let us send you Mr. Lawler's article and complete facts on McCaskey Tool Crib Control showing how you can have similar results in your plant, large or small.

McCASKEY REGISTER DIVISION
Victor Adding Machine Company
ALLIANCE, OHIO

Please send me the article describing use of McCaskey Tool Control by Lawler Automatic Controls, Inc. and complete facts concerning the McCaskey system.

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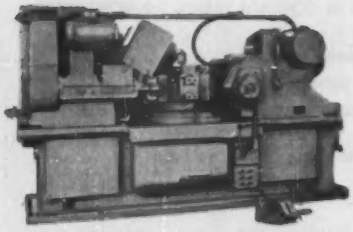
INDUSTRIAL CONTROLS
PRODUCTION - INVENTORY
TOOLS - MAINTENANCE - COSTS
THE McCASKEY REGISTER DIV.,
Victor Adding Machine Co.
ALLIANCE, OHIO
Galt, Canada — Watford, England



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When any of the various functions for which this machine is designed are performed on it, no further machining is required. The job is finished.

The basic "1-2-3" method—exclusive with Goss & DeLeeuw—provides for gripping work in the chuck and machining all ends either simultaneously or in sequence. By eliminating several handlings and set-ups, the "1-2-3" method produces finished pieces at a fraction of the time and cost ordinarily required.

Send samples of your work for time estimates. Ask for illustrated literature containing detailed information.

GOSS & DeLEEUW QUALITY PRODUCT-QUALITY

GOSS *and* DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

New Films...

THE RESISTANCE WELDING OF STAINLESS STEELS—*Allegheny Ludlum Steel Corp. Available from Resistance Welder Manufacturers' Assn, 1900 Arch St, Philadelphia 3, Penna. Running time 21 min. 16 mm, sound, color.*

Of particular value to production people, designers, engineers, and metallurgists, this film will also prove extremely useful in training courses and classes in technology. It records, step by step, the entire resistance welding operation, and covers the equipment used, the proper handling of stainless before welding, the different types of joints, and the precautions to be observed to retain the properties of stainless in the finished product.

•

METALWORKING — *Produced by McGraw-Hill Book Co, Text Film Dept, 330 W 42 St, New York 36, N Y. Correlated with the textbook* GENERAL METALS, *Feirer. Filmstrips (6), 35 mm, silent, black and white. Price per strip $5.50, set of six $30.*

Designed for industrial-arts courses in junior and senior high schools, these strips illustrate the proper equipment and materials for the various phases of Metalworking covered. Clear, simple captions, and close-up photography point up the techniques illustrated. Each strip can stand on its own but, for most effective use, should be considered as a visual aid in conjunction with the above-mentioned textbook.

Film 1, Cutting, deals with the cutting of heavy stock with the hand hacksaw, cutting straight lines and curves with the bandsaw, and the use of the various types of chisels. The power hacksaw and the continuous-blade cutoff saw are also covered. 38 frames.

Film 2, Filing, describes the main parts of a file and the general classification of files. The commonly used files, togther with their principal characteristics and uses are described. Step-by-step procedures are demonstrated, together with common mistakes that lead to poor filing. Cross-filing, draw-filing, and fine-filing are covered, plus important points in file care. 42 frames.

Film 3, Drilling, covers hand drills, electric hand drills, and the drill-

press. Methods of holding the work are shown, together with information on selecting drill sizes and drilling speeds. 37 frames.

Film 4, Layout and Cutting, shows specifications and gages of sheet stock, how to lay out work for maximum sheet economy, and how to cut with hand snips, squaring shears, and electric portable shears. Use of layout fluid, rules, dividers, and scribers is covered in detail. 38 frames.

Film 5, Forming and Seaming, shows the methods of hand and machine bending, and the making of straight-line bends and single- and double-hem bends on a bar folder. 50 frames.

Film 6, Making Trays and Bowls, demonstrates the procedure for making plywood forms and the forming of a tray from flat metal. Method of forming a bowl is also shown. Procedures for annealing, pickling, and decorating are covered. 55 frames.

•

IN EVERY V-BELT DRIVE—*Allis-Chalmers Mfg Co, Milwaukee 1, Wis. 35-mm slidefilm, sound, color. Running time, 20 min.*

The engineering principles that are basic to every V-belt drive are explained in this first of three new films. How the V-belt operates, why it drives, how it is constructed, and how it should be installed are the principal points covered.

•

FOR BETTER DRIVING—*Allis-Chalmers Mfg Co, Milwaukee 1, Wis. 35-mm slidefilm, sound, black and white. Running time 20 min.*

All the information needed by the maintenance man for the proper installation and maintenance of V-belts is given in this second of a new series of three films. Combining cartoon and photographic treatment, it gives step-by-step instruction on how to mount and align sheaves, how to install the belts, how to check tension, how to protect belts, and how to look for the causes of belt breakage.

•

SELECTING A DRIVE — *Allis-Chalmers Mfg Co, Milwaukee 1, Wis. 35-mm slidefilm, sound, black and white. Running time 20 min.*

Primarily for the design engineer, this third in a series of three new films employs the question and answer technique to explain in detail exactly how to select the type, size, and number of V-belts for any given application. The advantages of V-belt drive over other drives are carefully explained.

All these ½" diameter HI-HELIX END MILLS

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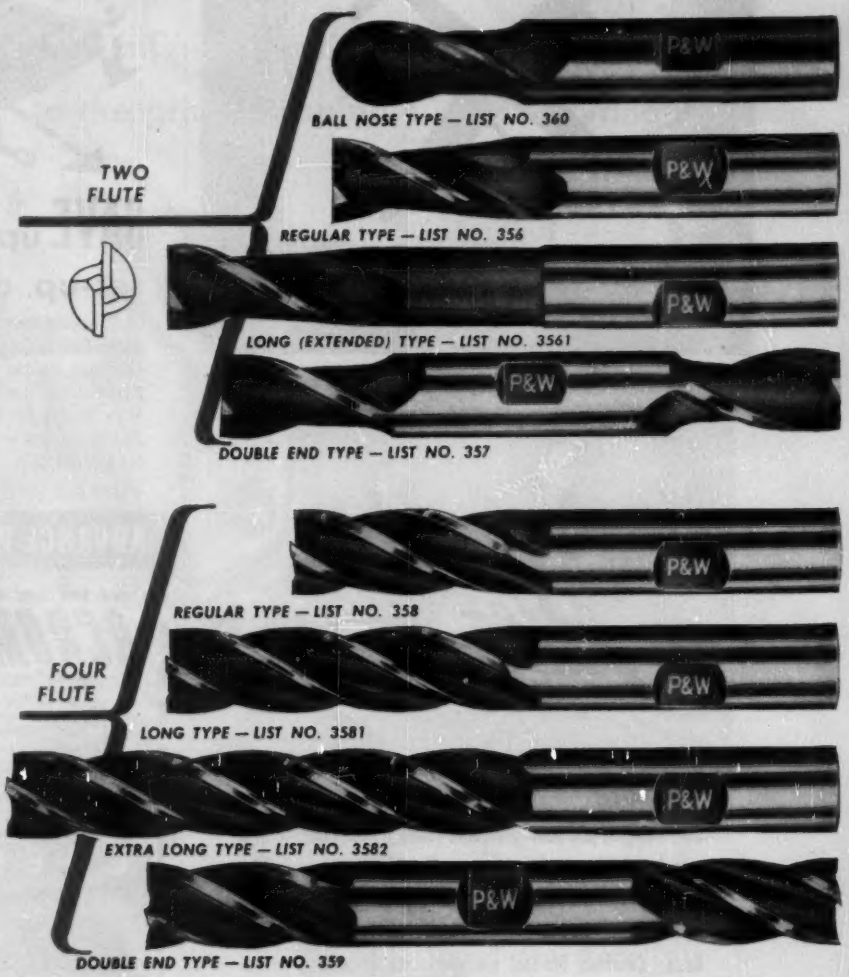
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Four Flute Styles are available in Two End Tooth Designs

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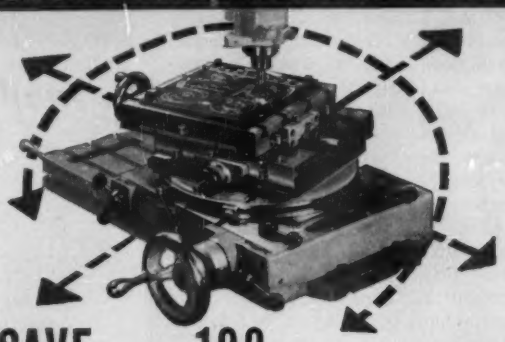

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ONLY the PATENTED construction of LUERS cutting off BLADES permits normal expansion of bursting chips. MEANS MAXIMUM CUTTING EFFICIENCY

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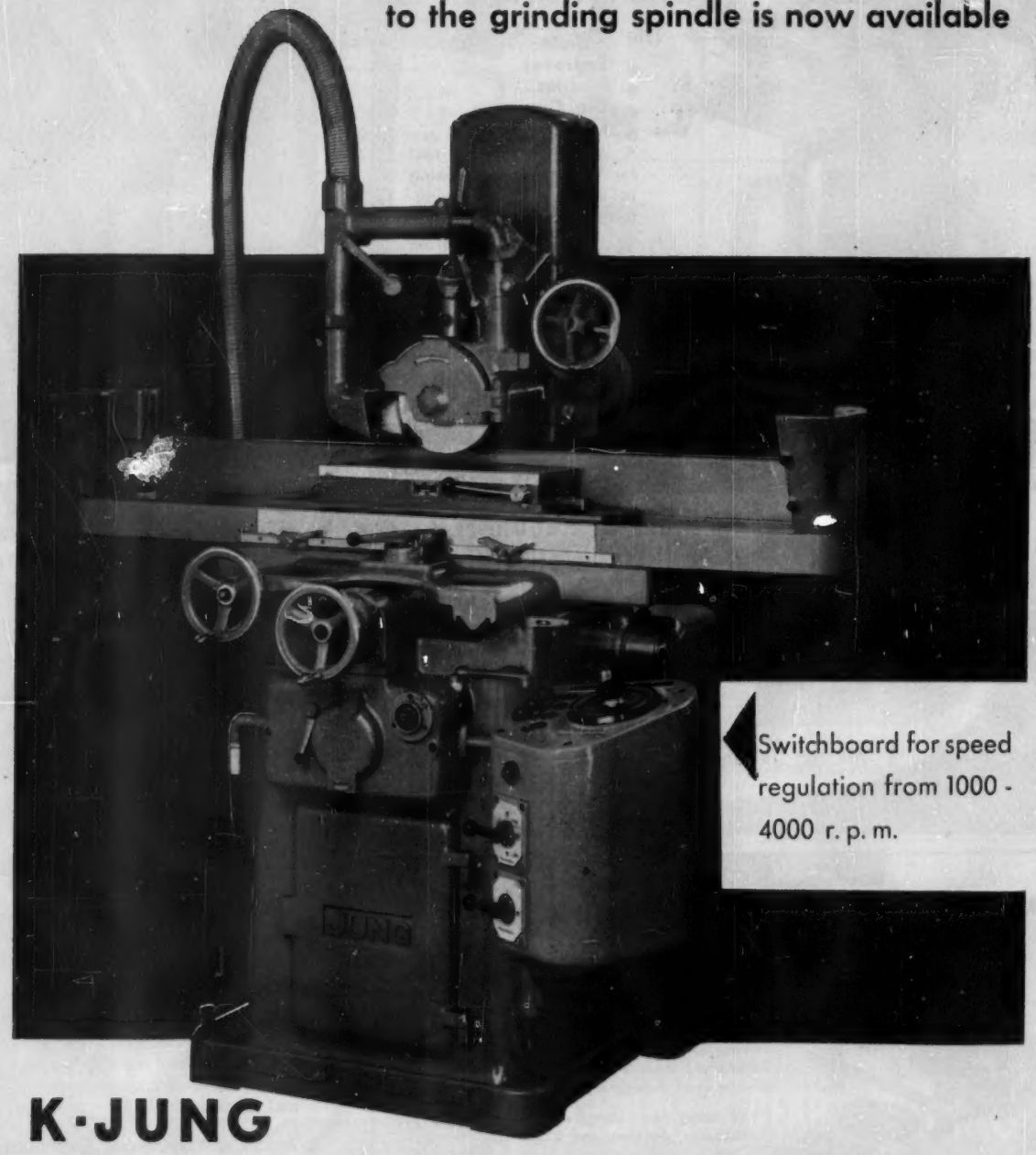

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NO BLOWER OR POWER NEEDED . . . *just connect to gas supply*

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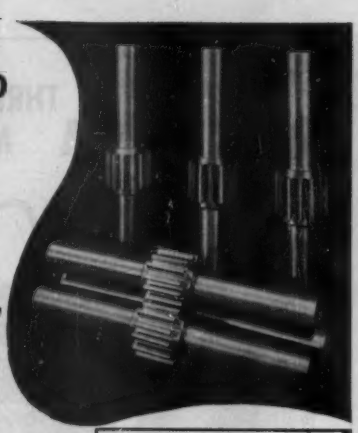
ALLOY FORGED
STEEL SHAFT

Spur Pinions



The alloy forged steel shaft spur pinions illustrated were precision-made by Stahl for use on forging presses. Your own gear needs can be equally well met by availing yourself of Stahl's specialized experience. For gears of any material—any size—any quantity—get Stahl's estimate first!

SPURS TO 72" PD, 1 DP
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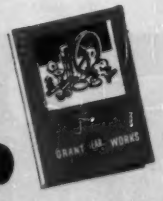

The full Grant line is described in the new catalog recently issued. Write for your copy today!

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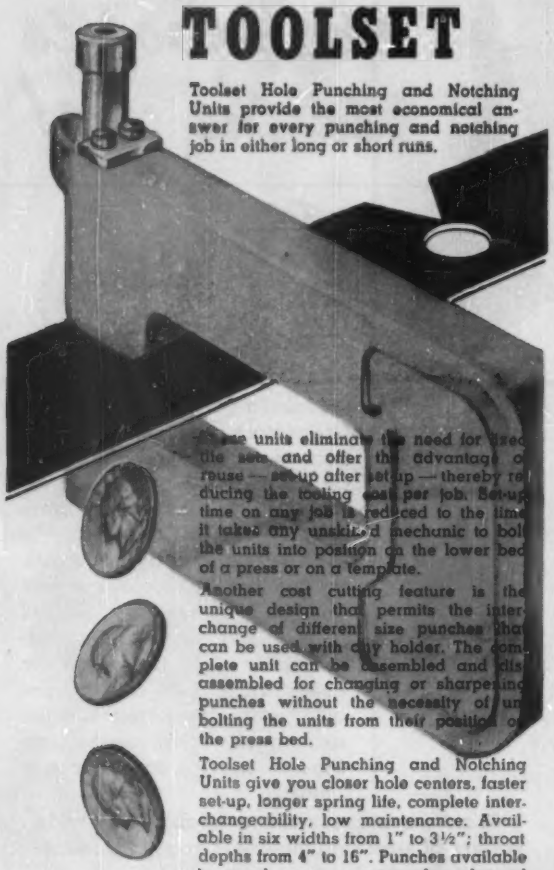

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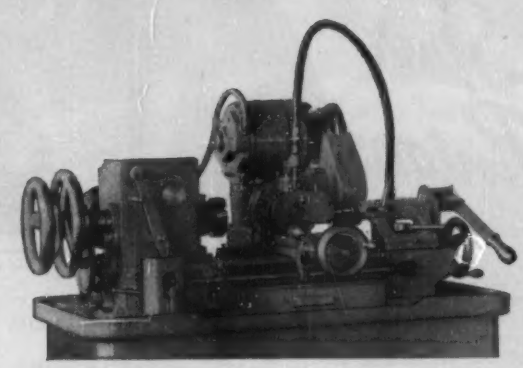

Several improvements in design have recently been made that are not mentioned in our descriptive bulletin. Send for supplementary sheet that lists these improvements and presents an illustration of the whole machine.

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The Brass

The new doorknobs on the Pentagon are brass, and GIs who recall the frosty remarks of some high ranking officers about their use of the term will get many a chuckle out of the change.

The old hardware on the main entrances was cast iron but it was rusting away and the building managers were reported to have received complaints about broken fingernails from some of the personnel. Since a taut military organization can't handle paperwork properly or even stand a passable inspection, on or off duty, under such conditions, we think the change is all for the better.

But we never could see the objection to the word "brass" as applied to the higher military echelon by those of lower rank. The term not only has a ring of authority to it, there is even good authority for its use. It comes from "brass hat" and Webster tells us that this means "a general or staff officer; — from the ornamental gold braid on the cap. *Slang.*" So those who want to try to stop use of the term must first stop using brass all over themselves and leave it for the doorknobs.

Even so some other descriptive terms will come about. A little poke at pomp and circumstance is part of a citizen military establishment. Any soldier who laughs at himself as nothing but "government issue" along with the guns and rations is not going to stop there.

Further, if the present GIs indulge in the same unrestrained nomenclature we remember, ranking officers ought to be happy to settle quickly for just brass.

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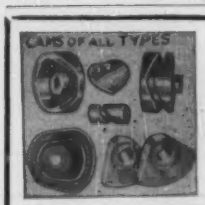

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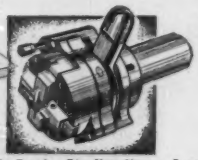

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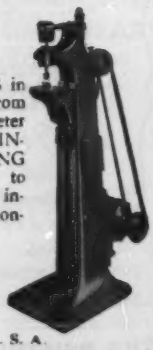

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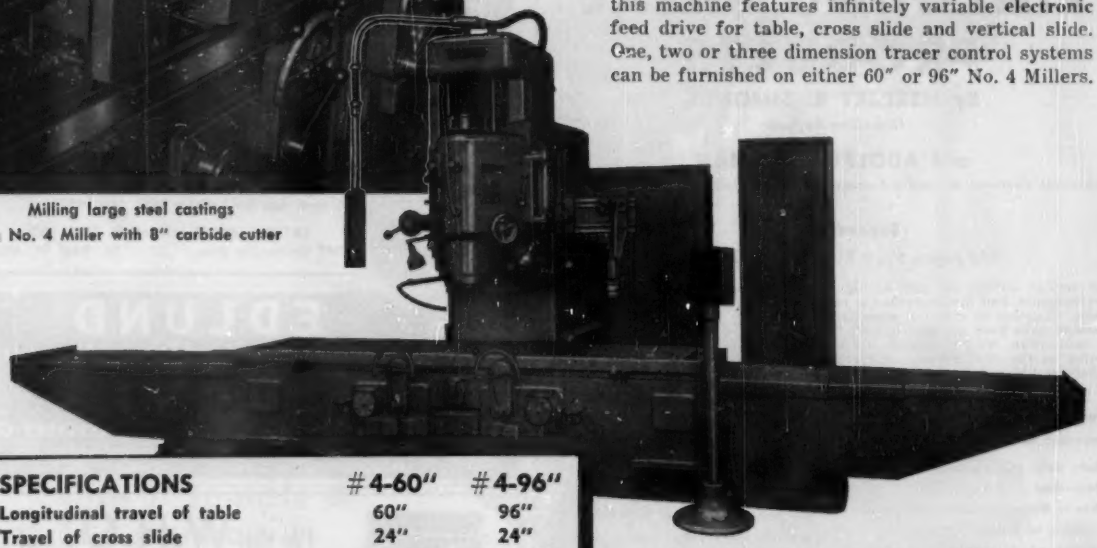

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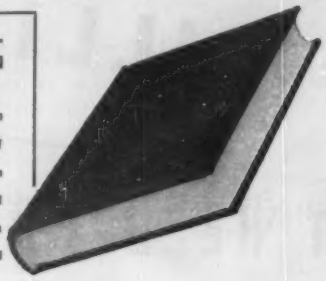

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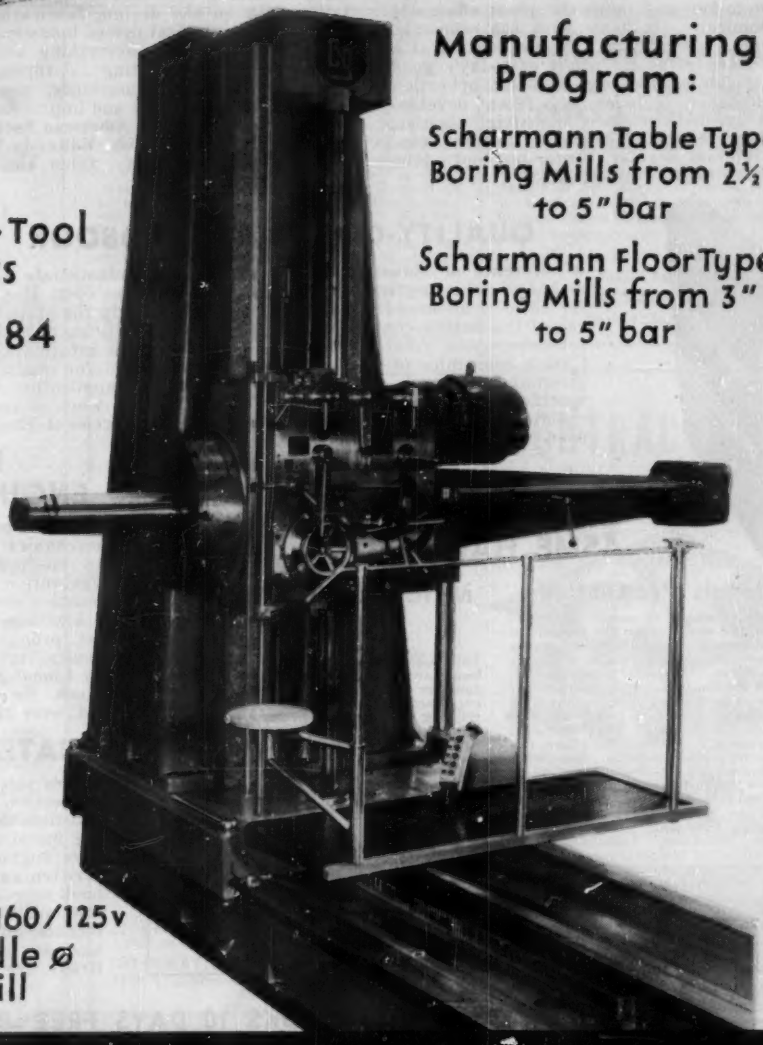

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FELLOWS: #12C Cone & Spacing Inspection Instrument
GLEASON: No. 8 Bevel Gear Tester
GLEASON No. 4 and No. 6 Bevel Gear Testers, Hand and Power
NATIONAL BROACH: SIC-12" Red Ring Gear Testing Machine

GEAR HOBBERS
CLEVELAND: #130 & 140 Rigidhobbers
REINECKER 60"
BROWN & SHARPE No. 44 20" cap.
SCHUCHARDT & SCHUTTE, 36" cap.
LEES BRADNER 49A

GRINDERS—CYLINDRICAL
BROWN & SHARPE: No. 10 cap. 6"x18" plain
CINCINNATI: 6"x18" Hydraulic, Plain
LANDIS: 16x32" Type "D" Crankpin, hydraulic, for grinding crankshafts
NORTON: 12"x18" Type C, Universal
NORTON: 10"x36", 30 Deg. Angle Wheel
NORTON: 10"x18" 45° angle wheel

GRINDERS—GEAR & SPLINE
GEAR GRIND MACH.: GG-19, 10"x24" Hydr. Spur Gears and Splines
GLEASON: #17, 23½" P.D.
PRATT & WHITNEY: 10" single and double INTERNAL GEAR GRINDER, GG-31 wheel, hydraulic feed

GRINDERS—INTERNAL
BRYANT: Nos. 5, 5Y, 16-16, 16-CP-16, 16-28, 24-L-36
HEALD: #50 Planetary
HEALD: #72A3 Sizematic
HEALD: #72A3 & #72A5 Extended Bridge

GRINDERS—RADIUS
VAN NORMAN: #73, capacity 7½"
VAN NORMAN: #649-16, cap. 6" to 16" dia.
VAN NORMAN: #3½" Un. Radius

HONING MACHINES
BARNES: Model 224, 4" dia. x 16" stroke
BARNES: Model 172, 2" dia. x 6" stroke.
MICROMATIC: H-510 Double End Horizontal, ¾" to 2" dia.
MICROMATIC: H-2 Single End Horizontal, 2 spindle, ¼" to 1" dia.

LAPPING MACHINES
FELLOWS: 8 LSI and 13 LSI Gear Lappers, external and internal spur and helical

LATHES—PRODUCTION
BLOUNT: Polishing speed lathe 12" dia. x 48" centers
LODGE & SHIPLEY: #3A Duomatic, 25½" swing x 27" centers
POTTER — JOHNSTON: #4D Auto Turret

LATHES—TURRET
BULLARD: 36" Vertical turret
WARNER & SWASEY: #1A, #2A, #3, #3A, #4, #4A & #5
HERBERT: #0, #2, #4, #7, #8 and #9B/30 Sizes, new

LATHES—TURRET—continued
WEBSTER & BENNETT: Vert. 36" & 48" (New)

MILLING MACHINES
TAYLOR-FENN: M-30 Duplex Spline
RICE-BARTON: 4" Twin Spline
VAN NORMAN: 10CT Contour Miller, horizontal opposed spindle type for milling flat cams, also can be converted to similar work

SAWS & CUT-OFF MACHINES
RUSSELL: 9½" cut-off Saw with Auto. Stock Feed (New) Hydraulic
RUSSELL: 8½" dia. cut-off saws, auto stock feed, hydraulic (New)
MOTCH & MERRYWEATHER: No. 3 Circular Saw with auto. stock feed
MARVEL: No. 6A Hacksaw, 6"x6"

THREAD MILLERS & TAPPERS
HALL PLANETARY: Mod "D" Thread Miller
LANDIS: 2½" single head horiz. threading machine
LEES-BRADNER: #40A Thread Miller
LEES-BRADNER: CT-36 Thread Miller chucking type, 13¼" hole
MURCHEY: #22 Horizontal threading and tapping machine, ¼" to 2½" dia. capacity.
NATCO: 16 spindle Tapper ⅜" cap.

MISCELLANEOUS
GARDNER: Model 84A Double Disc Grinder, 23" Wheel
MOLDING MACHINES, ROLLER JOLT: Osborne Model 2047-3
AUTOMATIC SCREW MACHINE, Wickman Single Spindle, 7/16" New
RACK CUTTING MACHINE: Sykes 12" to 36" length capacity (New)
CUT-OFF: Russell 5½" & 9½" cut-off saws with auto. stock feed (new) hydraulic
TEST STAND: Denison 918-AM Hyd.
HARDNESS TESTER: Grogan Brinell, 16-3
SHEFFIELD: Precisionaire Gauge
SUNDSTRAND: Double-End, #53, 42" & 60" Centering Mach.
WIRE FORMING MACHINES: 4-slides (new)

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No. 45 HEALD Borematic, Single End, Two Spindle
12x30" MONARCH Geared Head Lathes
22"x336" MONARCH Model "M" Lathe, Two Carriages, M.D. actual swing 27.5"
24"x12' Centers BOYE & EMMES Hvy Duty Engine Lathe
30"x16' bed AMERICAN High Duty Geared Head Lathe
36"x17' centers AMERICAN Heavy Duty Geared Head Lathe, 1941
42"x15' AMERICAN Heavy Duty Lathe
42"x25' centers AMERICAN Heavy Duty Lathe
60"x18' LeBLOND Heavy Duty Geared Head Lathe New 1952
Nos. 5A and 5Y BRYANT Internal Grinders
10x36 HILL CLARKE Plain Cylindrical Grinder
No. 172 HEALD Gap Internal Grinding Machine for large swing
18"x72" LANDIS Type C Hydraulic Plain Grinder —1942
24"x276" LANDIS Type B Hydraulic Pl. Grinder
Nos. 4D and 6S POTTER & JOHNSTON Automatic Lathes.
IL GISHOLT Universal Turret Lathe, 1946.
No. 8A JONES & LAMSON Saddle Type Universal Heavy Duty Turret Lathes.
No. 2 CINCINNATI HS Dial Type Plain Millers.
No. 0-8 CINCINNATI Plain Milling Machines.
No 2M CINCINNATI Vertical Miller 1941
FITCHBURG Plain Horizontal Mfg. Type Milling Machine, 24"x72" table.
No 1-18 CINCINNATI Plain Mfg Miller
No. 3B BROWN & SHARPE Dual Control Plain Miller
No. 3 CINCINNATI High Power Plain Miller with motorized overarm
3'11" CARLTON Radial Drill motor-on-arm
CINCINNATI BICKFORD Precision Drilling Machine with Bullard Man-au-Trol Table.
E-5 & 2AL NATCO Multiple Spindle Drilling Machine
Nos. 64 and 72 FELLOWS High Speed Gear Shapers
No. 12 FELLOWS Gear Shaver, 1943.
No. 36BM GOULD & EBERHARDT Gear Roughr
36" OHIO "DREADNAUGHT" H.D. Shaper
100" BETTS Vertical Boring Mill, 2 heads.

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6½" NILES, floor type 14x14' plate
4½" UNIVERSAL, table type
68" x 21' CC BRIDGEFORD, geared head
#11 BLANCHARD, 16" chuck, 1942
#18 BLANCHARD, 36" chuck, 1942
16" x 72" CINCINNATI Plain Cylindrical, 1943
20MB SMALLEY-GENERAL Thread Mill, 1942
24" x 32" x 36 ROCKFORD Openside Planer Shaper

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AUTOMATIC, Greenlee 4 spindle 1½" cap. acc. ream and threading spindle
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SCREW MACHINE, Brown & Sharpe #1 wire feed
TAPPER, Huller #3 UG½" cap.
DRILLING MACHINE, Snow #2 UD, universal
MILLING MACHINE, Kent-Owens #1 hand
BAND SAW, Walker Turner 16" metal
LATHE, Champion 15" 2 chucks
DRILL PRESSES, Walker Turner 15" (2)
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1 model 36 SW single wing tangent bender hydraulically powered-complete (except dies) and ready for operation, including 10 H.P. motor.
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27"x16' NILES, BEMENT, & POND Geared Head Lathe, 9' centers, M.D.

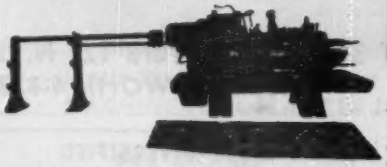
24", 36" BULLARD Vertical Turret Lathe, New Era, Turret Head, Side Head, Motor Driven.

No. 601 W.D. OSTER Motor Driven Turret Lathe, 1½" capacity, Late.

1A WARNER & SWASEY Turret Lathe, Heavy Duty, Power Chuck Wrench, Timken Bearing, M.D.

No. 2, No. 5 WARNER & SWASEY Geared Head Turret Lathes, Bar Feed, Motor Driven.

24"x10' AXELSON Geared Head, Heavy Duty Model "E" 28" Actual Swing, M.D. Taper Attachment.



No. 7 BARDONS & OLIVER Universal Turret Lathe. 2½" capacity. Preselector Head, Late Type.

No. 00G BROWN & SHARPE High Speed Automatic Screw Machine, Motor Driven, Late type.

No. 1 LaPOINTE Motor Driven Horizontal Broach, 5 tons cap., 30" stroke.

50 HP. CHICAGO PNEUMATIC Air Compressor. Type NSB, 253 CFM, Piston Displacement.

10"x10" RACINE #30-C Hydraulic Heavy Duty Shear Cut Power Hack Saw, 1946.

10'x10 ga., 10'x¼" WYSONG & MILES Power Squaring Shears, Motor Driven.

10'x10 ga. CINCINNATI Power Squaring Shear, many extra features; NEW 1948.

#7A THOMAS open back Inclinable Press 80 Ton cap. Flywheel M.D.

No. 5 FEDERAL Open Back Inclinable 4" stroke, Timken Bearing Flywheel, M.D.

600 ton NILES-BEMENT-POND Motor Driven Wheel Press, 86" between strain rods, 14' cap., 17" diam. ram.

#5, #7 JOHNSON O.B.I. Presses. 56, 79 tons cap. M.D. Flywheel & Geared Type.

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#2-18 CINCINNATI Plain Auto. Milling Machine, M.D. Late Type.

#2 KEMPSMITH Horiz. Maxi-Mill, Motor in base, Vert. Head.

#08 CINCINNATI Vert. Mill, Plain & Rotary Table Type.

#3B KEARNEY & TRECKER Vertical Milling Machine, Motor in base.

No. 0-8 CINCINNATI Rise & Fall Horiz. Mill, Late Model.

No. 3B KEARNEY & TRECKER Horiz. Mill, Double Overarm, Motor in base.

No. 2M CINCINNATI Universal Horizontal Mill, Full Equipment, M.D.

96" x 86" x 28' NEWTON PLANER TYPE MILLING MACHINE. 2 Heads on Rail; 2 Side Heads; Pendant Control; Late Type; Inspect under power.

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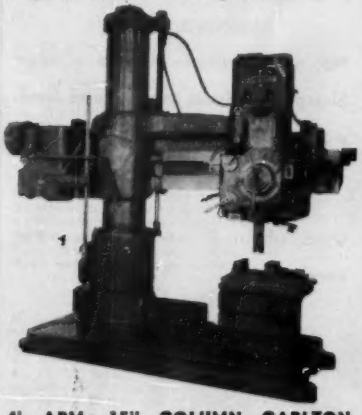
4'x15" Column CINCINNATI-BICKFORD "Super-Service" Radial Drill, Motor on arm, Box table.

No. 262 BARNES Motor Driven Sliding Head Drill Press. 2" cap. in steel.

No. 2 M.T. Six Spindle ALLEN Type KH Drill Press, Individual Motor Drive, Late Type.

No. M200 DEFIANCE Prod. Drill, 2" cap., #5 M.T., 26" swing, 1942.



4' ARM, 15" COLUMN CARLTON RADIAL DRILL. 48 SPINDLE SPEEDS 15-1500 RPM. MOTOR ON ARM. 1943.

½, 1½ BUFFALO FORGE Universal Ironworker, Notcher, M.D.

6'x¼" VERSON Power Press Brake, 8' overall, late type.

GRINDERS

12"x36" LANDIS Universal Cylindrical Grinder, Excello Internal Spindle, M.D.

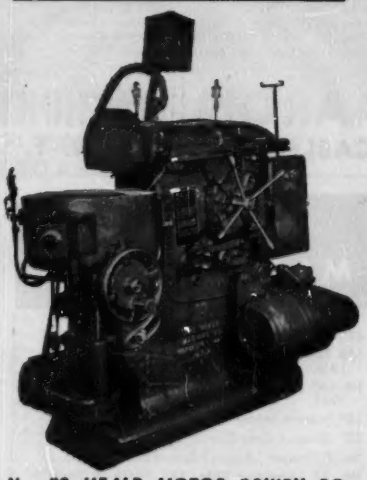
6"x18" LANDIS Type "C" M.D. Hyd. Cylindrical Grinder, Serial #29196.

6"x18" NORTON Vertical Hydraulic Surface Grinder, complete with magnetic chucks, coolant systems, Late.

#TG615 JONES & LAMSON Thread Grinder, Late, M.D. and TG848.

No. 208 BESLEY Motor Driven Disc Grinder, 26" wheels, Late Type.

12"x36" MATTISON M.D. Hydraulic Surface Grinder, 15 HP Spindle Motor.



No. 22 HEALD MOTOR DRIVEN ROTARY SURFACE GRINDER. 12" Magnetic Chuck. Late Model.

20", 24", 28" GOULD & EBERHARDT V-Ram Shapers, M.D.

No. 194 BARNES Vertical Hone, 4" capacity, 12" stroke, Motor Driven.

30 K.W. LEPEL High Frequency Induction Heater.

No. 8LS FELLOWS M.D. Gear Lapping Machine. With Detachable Head, Universal Work Support.

No. 20, WATERBURY FARREL Thread Roller, ⅜" cap., 1944.

15' x 10' x 36' BETTS PLANER, DOUBLE HOUSING, BOX TABLE, 2 Swivel Heads on Rail; 2 Swivel Side Heads; Pendant Control Variable Speed Main Drive Motor, 75 HP. Inspect under power.

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Brown & Sharpe (1) Model #4
Brown & Sharpe (2) Model 2G, 1¼" & 1½"
Brown & Sharpe (8) Model 0G, ⅜" capacity.
Brown & Sharpe (4) Model 00G, ⅜" capacity.
Coco Screw Machine ⅜" capacity.
Cleveland Model AA-11. Model B.
Cleveland 1¼", Conomatic 4 Sp.
New Britain 4 sp. Model 49.

BORING MILLS
Bullard 24" V.T.L. Spiral Drive
Bullard 8"—8 spindle, Multi-Matic
Cleveland 2½" Bar Capacity, Defiance 3¾" Bar
Giddings & Lewis #32, 3", #25, 2½" Bar
Kings 42", 72" Vertical 2 rail heads
Niles-Bement-Pond 4" 4½" Bar, 60" V.rt.
Ohio 5" Bar. Universal 3"
Morris 6'—Radial. Lucas 3" New 1951.

DRILLS AND RADIALS
American 6'x15", American 6'x17", 3'9"
Baker No. 321 Vertical Boring & Drill
Buffalo #2 Motor Spindle, #16—4 Sp.
Buffalo: Power No. 41, No. 42 RPMSTERS
Cincinnati Bickford 6'15" col. 3'9"
Natco #12, 20 spindle. Model B2A—10 Sp.
Leland-Gifford 2 LMS, 3MS

ENGRAVERS
Gorton #ME, 3U, 1D, 3Z, Deckel G1L, G1, G2
Gorton Graduating Mod. #687-1
Gorton P13 3 Dimensional Like New
Taylor-Hobson 3 dimensional Pantograph

GRINDERS, MISCELLANEOUS
Brown & Sharpe #2 Universal 14"x28", #3 Univ.
Brown & Sharpe #5, 3"x18" Cylindrical
Brown & Sharpe #13 Universal Tool & Cutter
Cincinnati 6x18" Hyd. #4—Centerless—#2
Douglas Tool & Cutter 8"x15"
Gardner Disc Grinder 30"—15 H.P. Motor
Heald 72A3 Int. Centerless Sizematic
J. & L. Thread; TG 615, Lempco 54" Swing
Landis 6"x30" Type C Cyl., 10x24 Univ. 12x30
Norton #2 Tool & Cutter, No. 1 Tool & Cutter
Norton Type C 6"x18" Semi-Automatic cyl.

GRINDERS, SURFACE
New 9x24" Hyd. Feed 10x8", 6x18
Abrasive 8x24", #33 Vert. & #34
Brown & Sharpe #5, #2 with Chuck
Gallmeyer & Livingston—65
Heald 22—12" chuck, Arter 12", Covel No. 15
Norton 6x18 Hyd. #15 Covel Hand.
Portman 12" Chuck Rotary
Pratt & Whitney 12x36" Vertical
Thompson 6x18, Reid 2A, 6x18

GEAR EQUIPMENT
Barber Colman #18 Hob Grinder
Barber-Colman Mod. SHS, Sharpener
Barber-Colman #3, #2, #12 (3) also Type 5
Fellows High Speed Shapers 712, 725, 71, 7, 61A
Gleason Gear Rougher, Gleason #6 Power Tester
Gleason #2 Surface Hardener, No. 3 Gear Tester
Gleason #3 Spiral, #3 Straight Bevel
Mikron No. 79 Gear Hobbers
Michigan Univ. Hob & Cutter Relieving
Sykes 2A Generator

LATHES
American 12"x30", Bridgeford 36"x20", 32"x16'
Cincinnati 22"x10'
Gisholt Simplimatic 18"x16¼", 2 Tables
Hendey 12"x42 and 12x30", 16x160"
LeBlond Regal 10"x3' bed, 13x42", 17" Late type
LeBlond 25/50x96" Gap, Late type.
Lodge & Shipley #3A Duomatics
Pratt & Whitney 16"x60, 10"x20", 16"x36
Monarch Magna-matic 14"x54"
Rivett Model 918 Precision. Mod. 715
Putnam, Sliding Gap 22"/46"x92"
Sebastian 14"x6", So. Bend 13"x42", 14"x28"
South Bend 13"x5' O.C.G., 10"x3½ Taper Att.
Sundstrand 8x15", 15' Stub

HYDRAULIC EQUIPMENT
Injection Molders, Pumps, Presses 125 to 800 Tons. Accumulators, Hobbing Presses, Etc.
Completely Engineered by a Competent Staff

MILLS, VERTICAL
Cincinnati (2)—1-18 Plain Automatic
Cincinnati #3, 08 Vertical
Gorton 8D Super Speed, 8½D, 9J
Milwaukee 4K & 2K
Morey #12M Profiler, 2 sp. #2 Maximiller
Reed Prentice Vert. Mill & Die Sinker Mod. 3VG

MILLS, PLAIN, UNIV. PROD.
Brown & Sharpe #0 Omniversal, #000 Production
Brown & Sharpe #2B Plain, No. 2, 3A, 21, #2L
Cinn. 08 Rise & Fall, 2-24 Automatic
Cinn. #3, 4 Plain, #18 Mfg. #5-48 Hydro.
Kent Owens IV, 1-8, 1-14, IM, 2-20
Milwaukee 2H Universal, 2H Plain
Milwaukee #2B, Plain & Univ.
Sundstrand #00, 0, Rigidmils
Sundstrand #3A Rigidmil with copying Attach, 33
Van Norman #2L Univ.
(8) Van Norman #12—Hor/vert—No. 36, 22

PRESSES
Bliss 650 Hi-Production Presses
Bliss 18, 19, 21, OBI, 53, 62, 162, OB
Bliss #78½, 330 Ton SS, Bliss 74½
Bliss 5-48 Dbl. 32x48" bed, Cushion
Hamilton 850 Ton S.S. Bed 27x48
Hamilton 110 FM Die Tryout Press
New 85, 60, 55, 30, 20, 15, 10, 5 Ton O.B.I.
Stokes Tablet Presses, Mod. R, RD3, RD3S, DDS
Thomas 56 Ton O.B.I.
Walsh No. 3 O.B.I. 23 Ton, L1 #3
Z & H #4½, O.B.I. 20 Ton, 36-6 Back Gear

TURRET LATHES
Bardons & Oliver #2, 3, 7 Bar Feed
Gisholt 2L, Cross Slid. Tur. & Hardinge DSM-59
Gisholt #5, Bar Feed, Plenty of Tools
Gisholt 4R—9¼" hole in spindles
Jones & Lamson Mod. 8A, No. 5
Warner & Swasey #1, 1A, 2, 2A, 3, 3A, 4, 5

MISCELLANEOUS
Band Saw: New Kalamazoo & Johnson. Grob.
Bending Roll: Reed-Power 5", 48"—8 ga.
Bolt & Pipe Threader: Landis, Oster-Williams
Broach: New 6-Ton Horizontal, 11 Ton Vertical
Hacksaw: Peerless 6"x6", Racine 6"x6", Marvel #9

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LATE TYPE MACHINE TOOLS

48" Jungenthal Vertical Turret Lathe. New.
650 Ton Verson Double Action Eccentric Press. 1940.
HP-100 LaPointe Horizontal Hydraulic Broach. 1945.
10" Pratt & Whitney Hyd. Gear Grinder. 1941.
12" Gleason Gear Generator. 1942.
No. 7 Gleason "Revex" Gear Rougher. 1943.
No. EF Cleveland Dble. End Punch & Shear—54" throat.
16"x72" Norton Univ. Grinder. 1942
17"x42" Norton Crank-o-Matic, 1943
645 Fellows Gear Shaper 1942
TG615 Jones & Lamson Precision. 1945.
No. 35 Excello Precision Thread Grinder. 1942.
20"x33" Fay Automatic Lathe 1942.
24-36 Bryant Hydraulic Internal Grinder. 1942.
No. 72A3 Heald Plain Hydraulic Internal Grinder. 1941.
#2 Cincinnati Centerless Grinder 1945
4" Moline Horiz. Boring Mill. 1943.
No. 6DRE Potter & Johnston Automatic. Late.
No. H5 Libby Universal Saddle Type Turret Lathe. 1939.
No. 3R Gisholt Universal Saddle Type Turret Lathe. 1942.
No. 33 Sundstrand Vertical Rigidmil 1943

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No. 7 Gleason Hypoid Cutter Sharpener. Hand index, hand feed with coolant. Manufactured Dec. 1948. Serial #24766.

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#12 Van Norman Miller
DIVINE Buffing Lathes
#10 W.F.F. Thread Roller
BILLINGS & SPENCER Di-matic
BROWN & SHARPE Automatics, several
P & W Contour Cutter Grinders
Model J BRIDGEPORT Vert. Miller
#40 LEES BRADNER Thread Millers
#2 NORTON Tool & Cutter Grinder
#12 MARTIN Marking Machines
#72 ETNA Swager

Numerous Other Machine Tools

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ELECTRIC FURNACE TO 1850°

with Auto Temperature Control. Sliding door. Cheap to operate. Substantial. Dependable for Machine Shop Tool Room.
8" x 12" x 15" inside 4.5 K.W. $250.00
12" x 16" x 20" inside 9.0 K.W. $500.00

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DISC GRINDERS

No. 2 Gardner, belted m.d.
No. 151 Besly, m.d.
Hammond Disc Grinder, model No. 600
Model V10 Hammond Belt Sander, m.d.
No. 4 Gardner Disc Grinder, m.d.
7½ H.P. U.S. Elec. Tool Co. Disc Grinder, m.d., new
14A Gardner Grinder, m.d.
No. 24—58" Gardner Horizontal, m.d.
No. 186—36" cap. Gardner, m.d., latest type

PLAIN CYLINDRICAL GRINDERS

6x15" Cincinnati Plain Hydraulic, m.d.
6x18" Cincinnati Model EA, m.d.
6x18" Cincinnati Model ER Plain Hydraulic, m.d., Filmatic Spindle
6x18" Landis Type C Hydraulic, m.d., late
6x30" Cincinnati Hydraulic, m.d.
10x18" Cincinnati Model EA, m.d.
10x18" Norton Type C, m.d., latest
10x36" Cincinnati Hydraulic, m.d.
10x72" Landis, m.d.
10x72" Norton, motorized
12x36" Landis, m.d.
12x96" Landis Plain Self-Contained, m.d.
14x18" Cincinnati Plain Self-Contained, m.d.
14x48" Cincinnati Plain Self-Contained, m.d.
14x52" Norton, motorized
16x72" Landis Plain, m.d.
16x120" Norton Type C, m.d., late
16" raised to 28"x72" type C Norton, m.d.
No. 20—10x18" Brown & Sharpe, m.d.
20x120" Landis Plain Self-Contained, m.d.

UNIVERSAL CYLINDRICAL GRINDERS

10x24" Landis Type C, m.d.
No. 3 Brown & Sharpe Universal Grinder, m.d.
6x20" Fitchburg Hydraulic Spline & Gear Grinder, m.d., latest
14x72" Cincinnati Model ER, m.d., latest type, Filmatic Spindle
12x48" Norton Universal, m.d., latest

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No. 50 Heald Hydraulic, m.d., 11-18" spindles
No. 73 Heald Airplane Cylinder Grinder, new, m.d.
Model FG Micro Cylinder Grinder, m.d.
No. 78 Heald Centerless Cylinder Grinder, m.d.

SURFACE GRINDERS

No. 2B Brown & Sharpe, m.d.
No. 121 Hanchett Production Face Grinder, type BD, m.d.
No. 16—26" Blanchard, m.d.
No. 22—12" Heald Rotary, m.d.
No. 33 Abrasive Vertical, m.d.
No. 269—16" Heald Rotary, belt
14" Pratt & Whitney Vertical, m.d.

HONING MACHINES

No. 854 Micromatic Vertical Honing Machine, m.d.
H1 Micromatic Horizontal Hydrohoner, m.d.
H4 Micromatic Horizontal Hydrohoner, m.d.
No. 6 Barnes Twin Spindle
Model #182 Barnesdrill Hone, m.d., latest
Model 306H Barnes, single spindle

INTERNAL GRINDERS

Model 5Y Bryant, m.d.
No. 16—16" Bryant, m.d., Hydraulic Hole Grinder
No. 16CR16 Bryant, m.d., latest
No. 16—22" Bryant, m.d., latest
No. 16—38" Bryant, m.d., latest
No. 24P—36" Bryant, m.d.
No. 24—21" Bryant, m.d.
No. 24-L-36 Bryant, m.d., late
No. 24-LW-36 Bryant, m.d., late
No. 44 Heald Facing Type Borematic, m.d.
No. 70A Heald, m.d., latest
No. 72 Heald Sizematic, m.d.
No. 72A Heald Sizematic "Duplex", m.d.
No. 72A Heald Gagematic, m.d.
No. 72A3 Heald Sizematic, m.d.
No. 72A3 Heald Gagematic, m.d.
No. 72A5 Heald Sizematic, m.d.
No. 72A5 Heald Plain, m.d.
No. 73 Heald Airplane, m.d., latest, new
No. 74 Heald, m.d.
No. 75A Heald, m.d., latest
No. 78 Heald Centerless Cylinder Grinders, m.d.
No. 81 Heald Gagematic, Sizematic, m.d.
No. 81 Heald Plain & Sizematic, m.d.
No. 649—16" Van Norman Automatic Oscillating Radius, m.d., latest
No 5 Bryant, m.d., latest

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#1 LeBlond Universal Tool & Cutter, m.d.
Gisholt Universal Tool Grinder, belt
Type 05D Sellers Drill Grinder, m.d.
No. 0-2 GP Sellers Drill Point Thinning Machine, m.d.
Grand Rapids Tap Grinder, style 12M
Gleason Cutter, belt drive
No. 2A Wm. Sellers Universal Tool Grinder, m.d.
No. 2B Sellers Wet Grinder, m.d.
No. 2 Lumsden Oscillating Tool Grinder, belted m.d.
No. 4T Sellers Tool, m.d., latest
No. 5T Sellers Tool, m.d.
No. 13 Gleason Cutter Sharpener, m.d., late
Pratt & Whitney Deep Hole Drill Sharpener, m.d., latest
Gould & Eberhardt Gear Cutter Grinder, 2 step cone pulley belt drive
Oliver Ace Universal Tool & Cutter Grinder, m.d.

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No. 48 Heald Boromatic precision late type
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4 ft. arm 13" column Carlton, MIB, late type
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No. 12H Gould & Eberhardt universal
No. 36H Gould & Eberhardt universal
72" Schuchardt & Schutte universal

GEAR MACHINERY, MISC.

8" Red Ring shaver, with crowning, 1943
10" Pratt & Whitney hyd. gear grinder, 1944
12" Model 224 Illinois involute profile measuring machine, new 1943
13" Model Sheffield gear chamferer, 1947
No. 5 Barber Colman auto. hob sharpener, 1944
Nos. 71A, 75A, 712 and 715 Fellows MS shapers

GRINDERS, CYLINDRICAL

4"x18" Cincinnati pl. hyd., plunge cut, 1946
10"x18" Norton type BA, A C. late models
10"x18" Cincinnati Almatic, type ER (2), 1941-1948
10"x36" Norton type C semi-auto., hyd. infeed
16"x36" Norton type C hydraulic (2), 1943
No. 13 Brown & Sharpe universal tool, 1942.
14"x36" Landis type C, hydraulic (2), 1946
16"x36" Norton type C, hydraulic (2) 1943
16"x60" Landis self-contained serial 11122
16"/26"x72" Norton type C, hydraulic, 1945
16"/42"x120" Landis gap type, hydraulic, serial 16193
16"/48"x96" Landis gap type hydraulic, new 1941

GRINDERS, SURFACE

16A2 Blanchard rotary surface, serial 6848, new 1945.
6"x18" Norton horizontal spindle, hydraulic, serial H303
8"x18" Norton vert. spdl. hydraulic, 1942
8"x22" No. 3 Abrasive, motor in base (2), 1941
12"x48" Model 300 Hanchett vert. spdl. 1946
14"x36" Pratt & Whitney vertical surface grinder, 1942.
72" No. 72 Hanchett rotary surface, 1946

GRINDERS, MISC.

No. 2 Cincinnati cutter grinder, late model
30" Ingersoll cutter grinder, late model

INTERNAL GRINDERS:

Nos. 72, 72A3 and 72A5 Heald
No. 5 Bryant semi-automatic chucking
No. 2 Cincinnati centerless (3), 1942-1943
No. 49 Van Norman radius, 1945

LATHES, ENGINE

14"/28"x36" centers Smith-Drum, gap, 1945.
32"x12" bed Axelson toolroom, serial 2578, new 1945.
14"x42" Hendey G.H., M.I.B., 1940
18"x96" Cisco G.H., 12 speed, swings 20"
24"x14 ft. bed American G.H., Q.C.G., serial 44870
52"x30 ft. bed Niles Bement Pond G.H., like new

LATHES, MFG. & MISC. & TURRET

9"x21" Sundstrand Mfg. lathe, serial 88-1234, 1945
14"x13 ft. bed Betts Bridgeford axle lathe
14"x18" Line H. S. Carbo-lathe, 1943
17"x72" LeBlond Rapid production (5), 1946-1947
No. H5 Libby International saddle type universal turret lathe, 1948
No. 5 Jones & Lamson Universal ram type turret lathes, (2) late models

MILLING MACHINES

1-12 Cincinnati production miller
No. 4-36 and 4-48 Cincinnati Hydromatic production
No. 2 Cincinnati high speed dial type plain
No. 2B and 3K Milwaukee universal
No. 3B and 5K Milwaukee universal
No. 3B and 4K Kearney & Trecker plain, late type
No. 22L Van Norman universal, 1943
12", 18", 24" Cincinnati plain manufacturing
No. 8 Becker heavy duty vertical
24"x24"x12 ft. Ingersoll adj. rail planer type mill, tracer controlled, 1945
30"x21"x12 ft. Ingersoll fixed rail planer type mill
42"x42"x18 ft. Ingersoll adj. rail double housing mill, 2 S.H. and 1 R.H. power on rail and head
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42" Ingersoll 2 spindle rotary continuous mill
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500 ton No. 1042 Verson, steel frame, air clutch, late model

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Monarch Model EE 10"x20" ctrs.—Swing over ways 12½"—MD—Late
Monarch Model W 16"x30" ctrs.—Swing over ways 18½"—Taper attachment—MD—Late
Hendey 14"x30" ctrs.—Taper attachment—MD

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Brown & Sharpe #2 Light Type Plain—Range 28"x 10"x15"—Coolant—Flange type MD—Late
Van Norman #26 Plain—Range 28"x12"x19"—#50 taper—Coolant—MD—Late
Milwaukee #2H Vertical Sliding Head—Speeds 35 to 1400 RPM—#50 taper—MD—Late
Rowbottom Cam Miller—32" outside dia.—Face cams to 28" dia.—Barrel cams to 24" dia.—6 speeds—MD

DRILLS

Leland-Gifford #2LMS Three-Spindle—Hydraulic feed to two outside spindles—Motorized spindles—Coolant—Late
Leland-Gifford #2LMS Six-Spindle—4 power feed and 2 hand feed motorized spindles—3 spindles backgeared—Late

MISCELLANEOUS

Gorton 3-7 Pantograph—Removable collet type spindle—Copy holder—MD—Purchased in 1954 and used less than 30 hours
Norton #26 Hyprolap—Recently rebuilt—10 HP MD
Campbell #401 Abrasive Cut-Off—Cap. 6" dia.—MD—Rebuilt
Racine 10"x10" Hydraulic Shear Cut Hack Saw—Coolant—MD—Late

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36"x12' centers AMERICAN Heavy Duty 16 Speed Geared Head Lathe, AC-MD
60"x20' NILES-BEMENT-POND Geared Head Engine Lathe, rapid traverse
No. 3 WARNER & SWASEY Turret Lathes, one bar feed, one chucker. New 1944
No. 4 WARNER & SWASEY Universal Turret Lathe, Preselector head, bar feed, late type.
No. 2 VAN NORMAN Plain Horizontal Mill. New 1943
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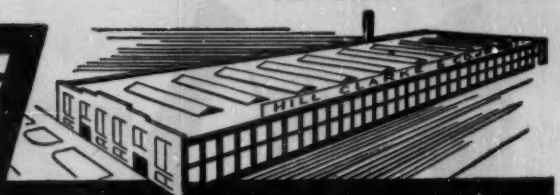

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Automatics
1-1/16" Cleveland Model A (1942).

Boring Machines
No. DB2112 Excello Single End Borer.
100" Niles-B-Pond Vert. Bor. Mill.

Drills
No. 2 Avey Cam Fd. Drill. 14" Swing.
No. 2MA-6 Avey 24"-1 Spol. Drill.
2 Spdl.—24" SW.—No. 3 Avey.
No. K60H Fox 16 Spdl. Multi Drill
No. 2-20" 2 Spdl. Leland-Gifford LMS Drill
No. LBM-20" 3 Spdl. Leland-Gifford Drill.

Gear Machines
11" Gleason Gear Generator.
No. 12HS Gould & Eberhardt.
No. 36-BM G. & E.—3 spdl. Rougher.
615-A Fellows Gear Shaper.
612-A Fellows Gear Shaper.

Grinders
6"x18" Norton Type C Plain (1943).
10"x18" Norton Type C Plain Hyd. Cam Gdr.
10"x36" Norton Type C Grinder.
10"x36" Norton Type C Cam Grinder.
16"-40" Gap x 120" Norton Pl.
20" x 192" Norton Type A Pl.
B-24—25" Chuck Arter Surf. Gdr.
TG615 J & L Thread Gdr.
No. 214 Besly Double End Disc Gdr.

Internal Grinders
No. 5 Bryant Internal Grinder.
No. 5B Bryant Internal Grdr.
No. 16-16 Bryant Int. Grinder.
No. 16-28 Bryant Int. Grinder.
No. 16-38 Bryant Int. Gdr.
No. 24 L-36 Bryant Hyd. Int. Gdr.
No. 16 A-28 Bryant Internal Grinder.
No. 24-26 Bryant Int. Grinder.
No. 24-36 Bryant Internal Grinder.
No. 81 Heald Internal Centerless.
72-A5 Heald Int. Gdr. (1942).

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10"x36" Centers. 14"x36" Centers.
10"x72" Centers. 14"x50" Centers.
10"x96" Centers. 14"x72" Centers.
18"x96" Centers. 14"x96" Centers.
18"-30" gap x 96" Centers.
18"x120" Centers
26"x96" Norton.

Hones
Model H-2 Micromatic Horiz. Hone.
Model 200-H5-Dbl. End. Micro. Horiz.
Model H-7 Micromatic Vert. Hone, etc.
No. 224 Barnes Vert. Hone.
No. 306-H Barnes Vertical Hone.

Lathes
R-14 Lo-Swing Automatic Lathe.
12"x21" Fay Automatic Lathe
12"x68" Fay Automatic
18"x6' Am. Geared Head Lathe.
27"x12' American Geared Hd. Lathe.
36"x18' Putnam Grd. Hd. M.D.

Turret Lathes
No. 6W Acme Tur. Lathe (Late).
No. 2 Warner & Swasey Geared Head.
No. 3AL Gisholt, Cross-Slide Turret.
No. 3 Warner & Swasey Turret Bar Feed.
No. 4A Warner & Swasey Turret.
No. 6 Warner & Swasey, cone head.
2½"x24" Jones & Lamson.
18" Libby, M.D.
No. 3H-10 Libby International, 29" SW
No. 4A Warner & Swasey (1944).

Planers
48"x36"x14' Gray, 2 Heads.
48"x48"x12' Cincinnati, 2 Heads.
60"x48"x27' American, 4 Heads.

Milling Machines
No. 4 Cinn. Pl. Hi-Speed Dial Type (1944).
No. 3K Kearney & Trecker Vert.
No. 08 Cincinnati Vert. (1942).
10"x48" Hanson-Whitney Thrd. Mill.
10"x60" Pratt & Whitney Thrd. Mill.
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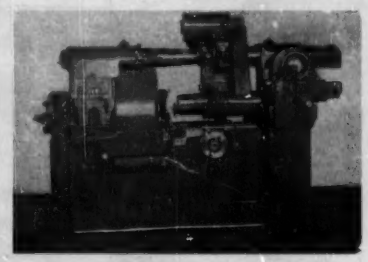

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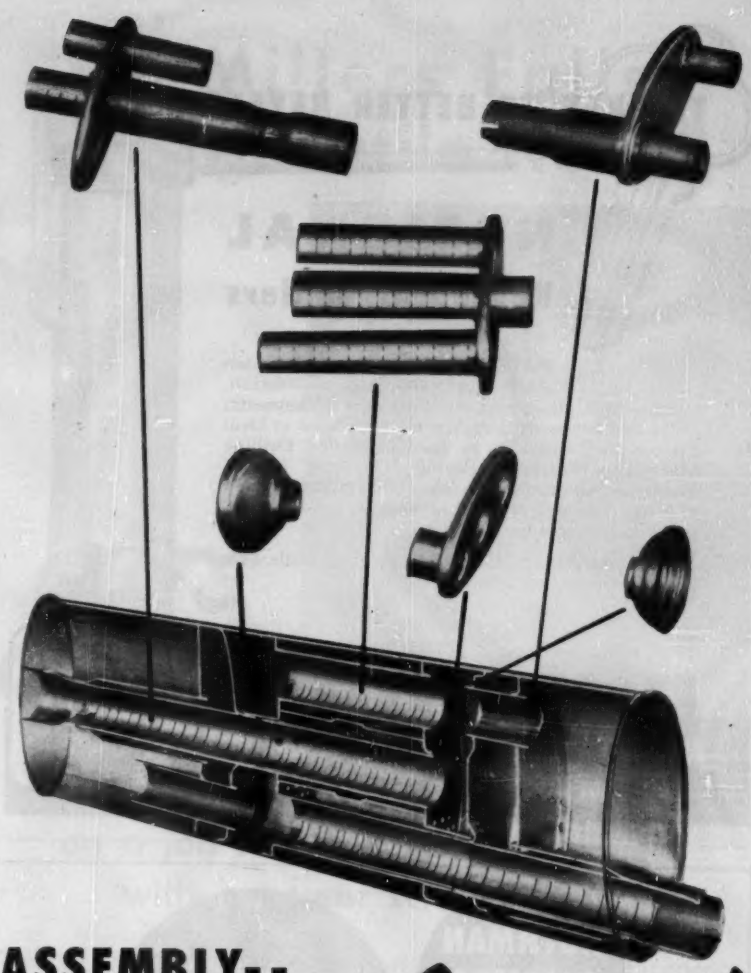

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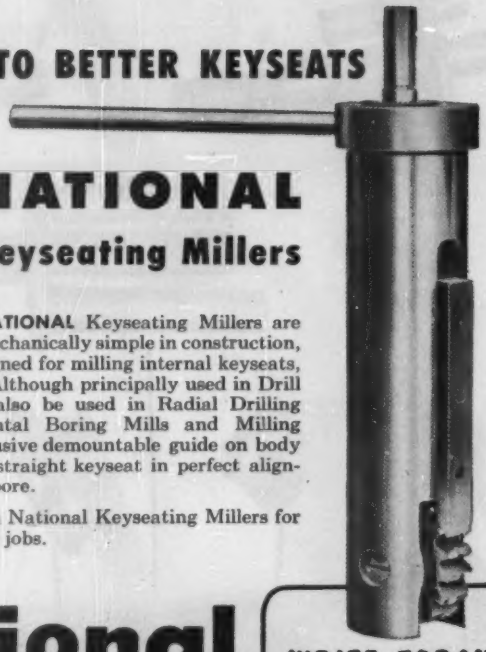

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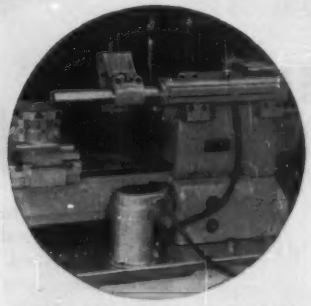

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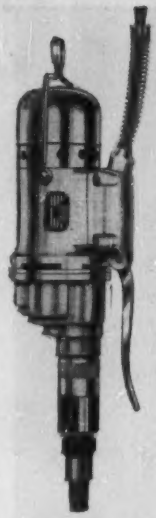

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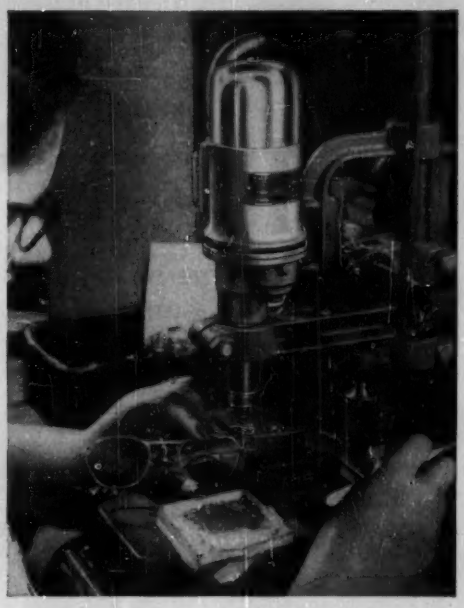

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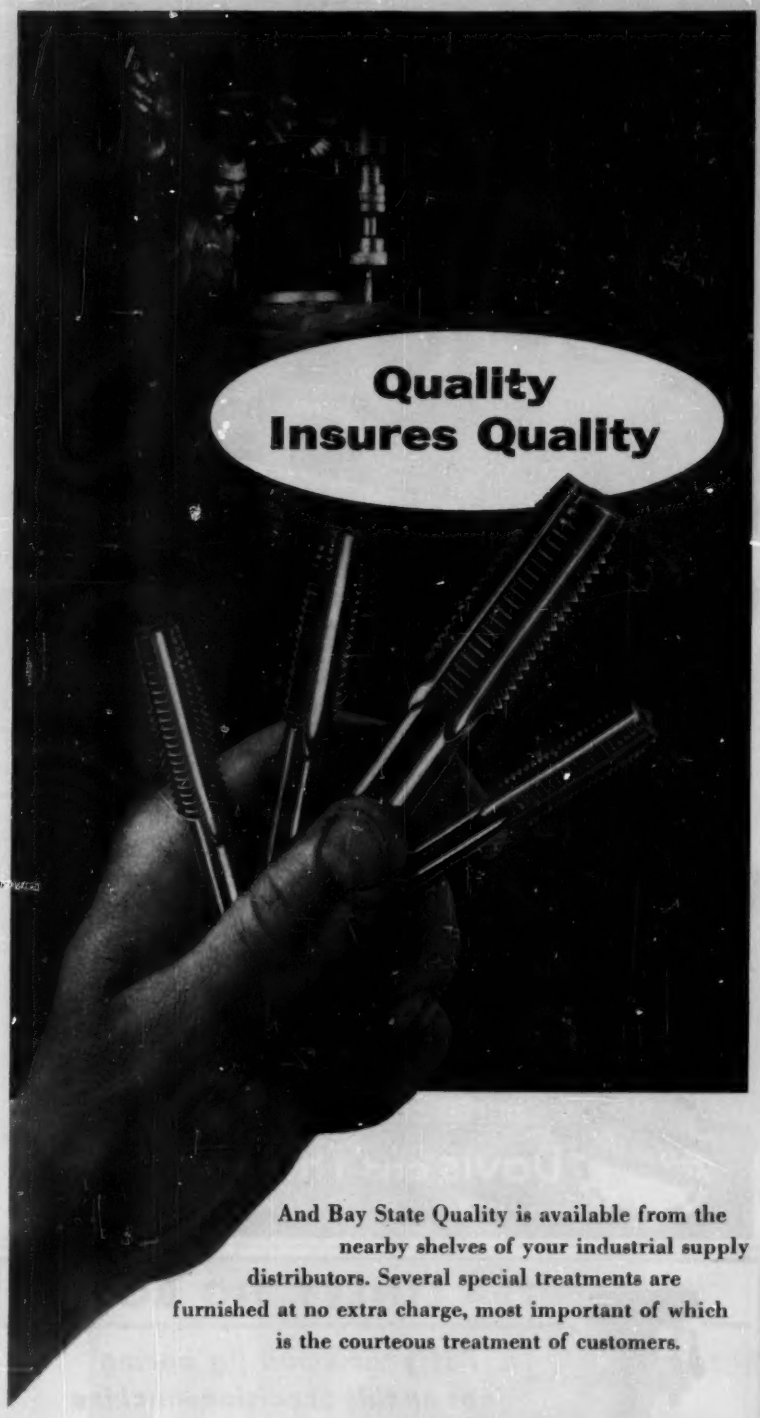

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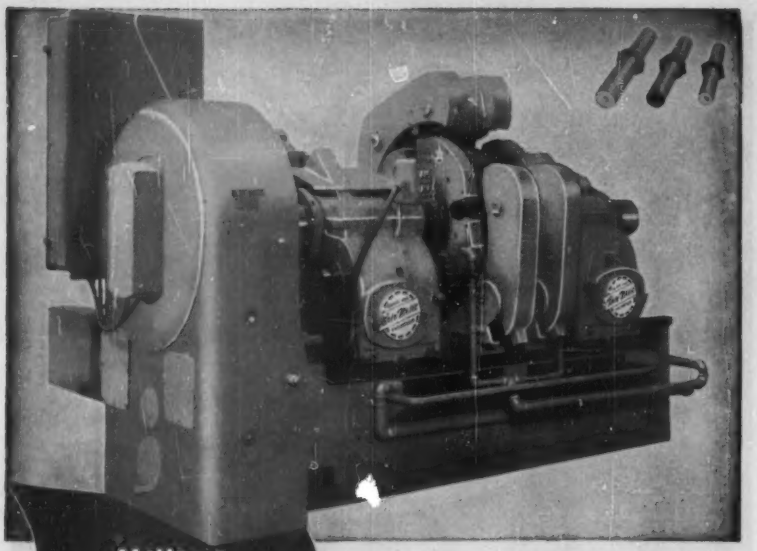

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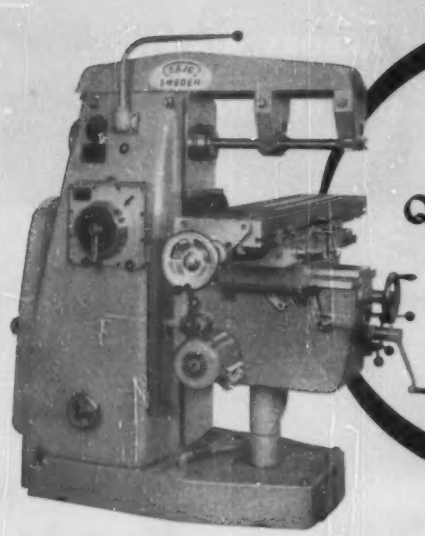

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Reduction of tap costs by as much as 50 to 75% — and more — is reported by leading metalworking firms using the B.P.S.* System. Why not get the same benefits?

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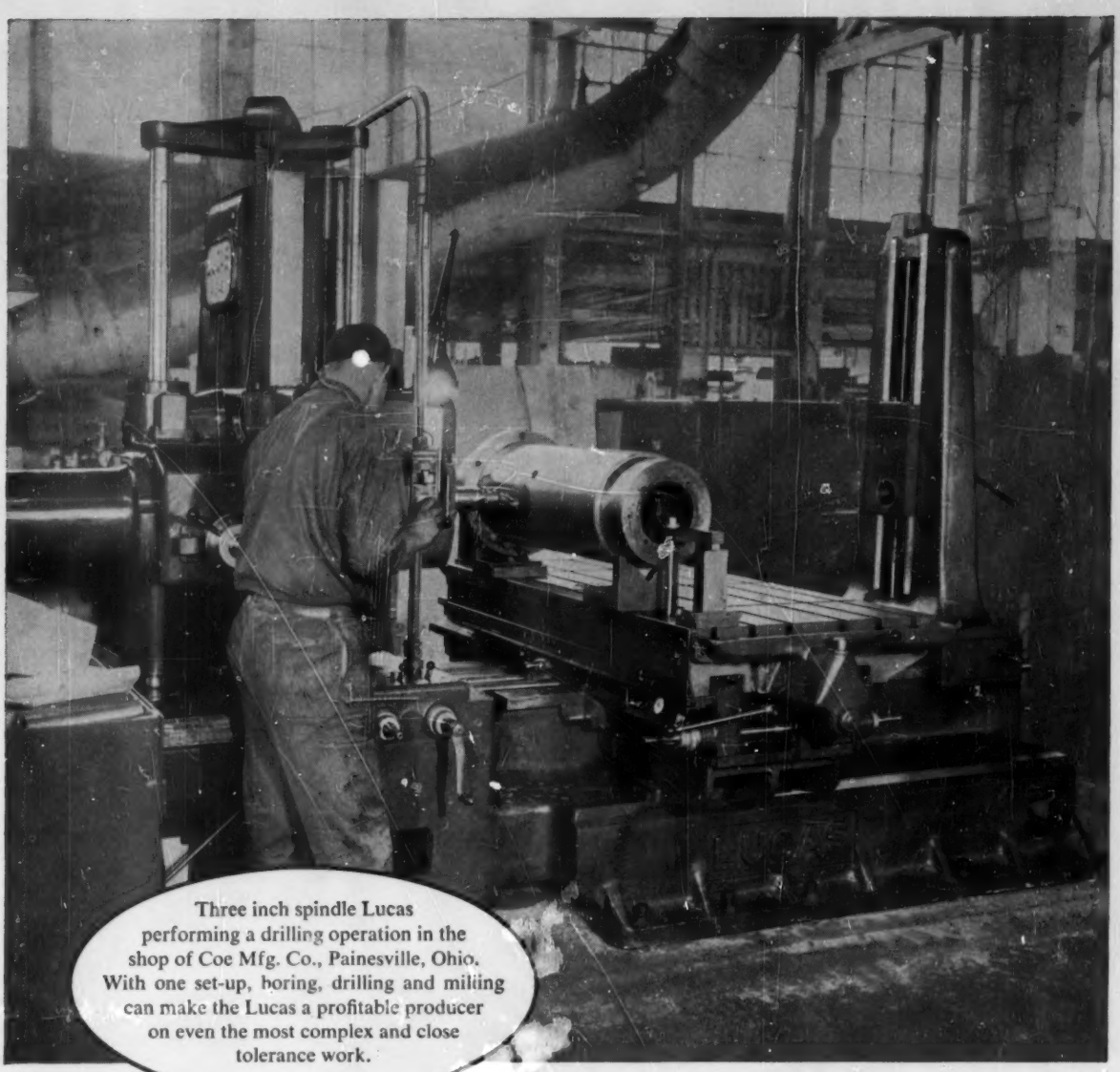

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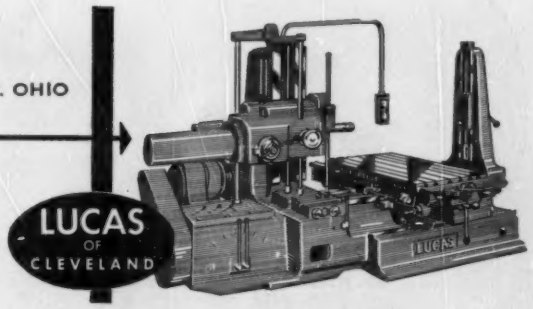

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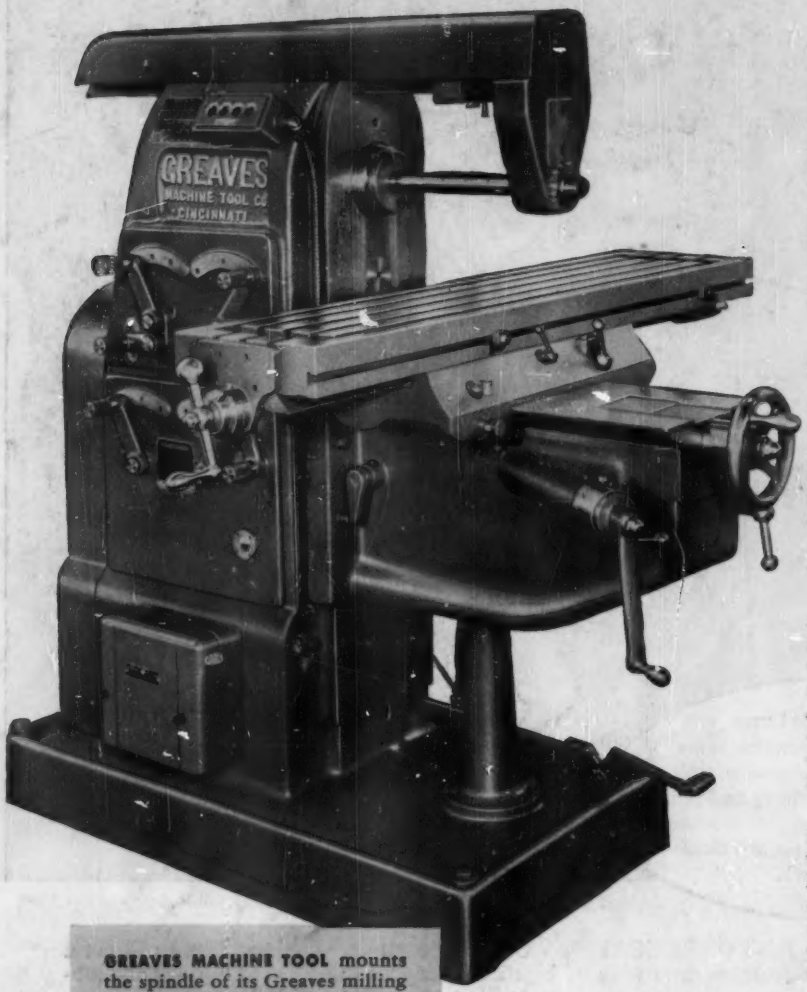

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FOR 15 years, the Greaves Machine Tool Division of J. A. Fay and Egan Company have been assuring customers of lasting spindle precision by specifying Timken® tapered roller bearings for their machine tools. Typical example is this Greaves 2-H plain and universal milling machine which features 18 feeds and 18 speeds to provide the one best speed-feed combination for every type of work and material.

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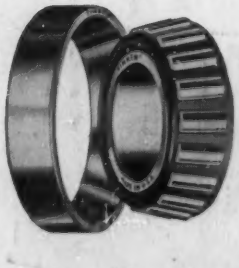

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